MITSUBISHI ELECTRIC

Mitsubishi Programmable Controller

MELSEC iQ-R series

# MELSEC iQ-R Simple Motion Module User's Manual (Application)

RD77MS2
RD77MS4
RD77MS8
RD77MS16

# SAFETY PRECAUTIONS

(Read these precautions before using this product.)
Before using this product, please read this manual and the relevant manuals carefully and pay full attention to safety to handle the product correctly.
The precautions given in this manual are concerned with this product only. Refer to the user's manual of the CPU module to use for a description of the PLC system safety precautions.
In this manual, the safety precautions are classified into two levels: "⚠WARNING" and "⚠CAUTION".

| | |
|---|---|
| ⚠ **WARNING** | Indicates that incorrect handling may cause hazardous conditions, resulting in death or severe injury. |
| ⚠ **CAUTION** | Indicates that incorrect handling may cause hazardous conditions, resulting in minor or moderate injury or property damage. |

Under some circumstances, failure to observe the precautions given under "⚠CAUTION" may lead to serious consequences.
Observe the precautions of both levels because they are important for personal and system safety.
Make sure that the end users read this manual and then keep the manual in a safe place for future reference.

## [Design Precautions]

### ⚠WARNING

- Configure safety circuits external to the programmable controller to ensure that the entire system operates safely even when a fault occurs in the external power supply or the programmable controller. Failure to do so may result in an accident due to an incorrect output or malfunction.
  (1) Configure external safety circuits, such as an emergency stop circuit, protection circuit, and protective interlock circuit for forward/reverse operation or upper/lower limit positioning.
  (2) The programmable controller stops its operation upon detection of the following status, and the output status of the system will be as shown below.
    • Turned off if the overcurrent or overvoltage protection of the power supply module is activated.
    • Held or turned off according to the parameter setting if the self-diagnostic function of the CPU module detects an error such as a watchdog timer error.
  (3) Also, all outputs may be turned on if an error occurs in a part, such as an I/O control part, where the CPU module cannot detect any error. To ensure safety operation in such a case, provide a safety mechanism or a fail-safe circuit external to the programmable controller. For a fail-safe circuit example, refer to the user's manual of the CPU module to use.
  (4) Outputs may remain on or off due to a failure of a component such as a relay and transistor in an output circuit. Configure an external circuit for monitoring output signals that could cause a serious accident.
- In an output circuit, when a load current exceeding the rated current or an overcurrent caused by a load short-circuit flows for a long time, it may cause smoke and fire. To prevent this, configure an external safety circuit, such as a fuse.
- Configure a circuit so that the programmable controller is turned on first and then the external power supply. If the external power supply is turned on first, an accident may occur due to an incorrect output or malfunction.
- For the operating status of each station after a communication failure, refer to manuals relevant to the network. Incorrect output or malfunction due to a communication failure may result in an accident.

## ⚠WARNING

- When connecting an external device with a CPU module or intelligent function module to modify data of a running programmable controller, configure an interlock circuit in the program to ensure that the entire system will always operate safely. For other forms of control (such as program modification, parameter change, forced output, or operating status change) of a running programmable controller, read the relevant manuals carefully and ensure that the operation is safe before proceeding. Improper operation may damage machines or cause accidents.
- Especially, when a remote programmable controller is controlled by an external device, immediate action cannot be taken if a problem occurs in the programmable controller due to a communication failure. To prevent this, configure an interlock circuit in the program, and determine corrective actions to be taken between the external device and CPU module in case of a communication failure.
- Do not write any data to the "system area" and "write-protect area" of the buffer memory in the module. Also, do not use any "use prohibited" signals as an output signal from the CPU module to each module. Doing so may cause malfunction of the programmable controller system. For the "system area", "write-protect area", and the "use prohibited" signals, refer to the user's manual for the module used.
- If a communication cable is disconnected, the network may be unstable, resulting in a communication failure of multiple stations. Configure an interlock circuit in the program to ensure that the entire system will always operate safely even if communications fail. Failure to do so may result in an accident due to an incorrect output or malfunction.
- To maintain the safety of the programmable controller system against unauthorized access from external devices via the network, take appropriate measures. To maintain the safety against unauthorized access via the Internet, take measures such as installing a firewall.
- Configure safety circuits external to the programmable controller to ensure that the entire system operates safely even when a fault occurs in the external power supply or the programmable controller. Failure to do so may result in an accident due to an incorrect output or malfunction.
  (1) Machine home position return is controlled by two kinds of data: a home position return direction and a home position return speed. Deceleration starts when the near-point dog signal turns on. If an incorrect home position return direction is set, motion control may continue without deceleration. To prevent machine damage caused by this, configure an interlock circuit external to the programmable controller.
  (2) When the module detects an error, the motion slows down and stops or the motion suddenly stops, depending on the stop group setting in parameter. Set the parameter to meet the specifications of a positioning control system. In addition, set the home position return parameter and positioning data within the specified setting range.
  (3) Outputs may remain on or off, or become undefined due to a failure of a component such as an insulation element and transistor in an output circuit, where the module cannot detect any error. In a system that the incorrect output could cause a serious accident, configure an external circuit for monitoring output signals.
- If safety standards (ex., robot safety rules, etc.,) apply to the system using the module, servo amplifier and servomotor, make sure that the safety standards are satisfied.
- Construct a safety circuit externally of the module or servo amplifier if the abnormal operation of the module or servo amplifier differs from the safety directive operation in the system.
- Do not remove the SSCNETⅢ cable while turning on the control circuit power supply of Multiple CPU system and servo amplifier. Do not see directly the light generated from SSCNETⅢ connector of the module or servo amplifier and the end of SSCNETⅢ cable. When the light gets into eyes, you may feel something wrong with eyes. (The light source of SSCNETⅢ complies with class1 defined in JISC6802 or IEC60825-1.)

## [Design Precautions]

### ⚠CAUTION

- Do not install the control lines or communication cables together with the main circuit lines or power cables. Keep a distance of 100 mm or more between them. Failure to do so may result in malfunction due to noise.
- During control of an inductive load such as a lamp, heater, or solenoid valve, a large current (approximately ten times greater than normal) may flow when the output is turned from off to on. Therefore, use a module that has a sufficient current rating.
- After the CPU module is powered on or is reset, the time taken to enter the RUN status varies depending on the system configuration, parameter settings, and/or program size. Design circuits so that the entire system will always operate safely, regardless of the time.
- Do not power off the programmable controller or do not reset the CPU module during the setting registration. Doing so will make the data in the flash ROM undefined. The data need to be set in the buffer memory and to be written to the flash ROM again. Doing so may cause malfunction or failure of the module.
- Reset the CPU module after changing the parameters. Failure to do so may cause malfunction because the previous parameter settings remain in the module.
- When changing the operating status of the CPU module from external devices (such as remote RUN/STOP), select "Do Not Open by Program" for "Opening Method" in the module parameters. If "Open by Program" is selected, an execution of remote STOP causes the communication line to close. Consequently, the CPU module cannot reopen the communication line, and external devices cannot execute the remote RUN.

## [Installation Precautions]

### ⚠WARNING

- Shut off the external power supply (all phases) used in the system before mounting or removing the module. Failure to do so may result in electric shock or cause the module to fail or malfunction.

## [Installation Precautions]

### ⚠CAUTION

- Use the programmable controller in an environment that meets the general specifications in the manual "Safety Guidelines" included in the base unit. Failure to do so may result in electric shock, fire, malfunction, or damage to or deterioration of the product.
- To mount a module, place the concave part(s) located at the bottom onto the guide(s) of the base unit, and push in the module until the hook(s) located at the top snaps into place. Incorrect mounting may cause malfunction, failure, or drop of the module.
- When using the programmable controller in an environment of frequent vibrations, fix the module with a screw.
- Tighten the screws within the specified torque range. Undertightening can cause drop of the screw, short circuit, or malfunction. Overtightening can damage the screw and/or module, resulting in drop, short circuit, or malfunction.
- When using an extension cable, connect it to the extension cable connector of the base unit securely. Check the connection for looseness. Poor contact may cause incorrect input or output.
- When using an SD memory card, fully insert it into the memory card slot. Check that it is inserted completely. Poor contact may cause malfunction.
- Securely insert an extended SRAM cassette into the cassette connector of a CPU module. After insertion, close the cassette cover and check that the cassette is inserted completely. Poor contact may cause malfunction.
- Do not directly touch any conductive parts and electronic components of the module, SD memory card, extended SRAM cassette, or connector. Doing so may cause malfunction or failure of the module.

## [Wiring Precautions]

### ⚠WARNING

- Shut off the external power supply (all phases) used in the system before installation and wiring. Failure to do so may result in electric shock or damage to the product.
- After installation and wiring, attach the included terminal cover to the module before turning it on for operation. Failure to do so may result in electric shock.

## [Wiring Precautions]

### ⚠CAUTION

- Individually ground the FG and LG terminals of the programmable controller with a ground resistance of 100 ohm or less. Failure to do so may result in electric shock or malfunction.
- Use applicable solderless terminals and tighten them within the specified torque range. If any spade solderless terminal is used, it may be disconnected when the terminal screw comes loose, resulting in failure.
- Check the rated voltage and signal layout before wiring to the module, and connect the cables correctly. Connecting a power supply with a different voltage rating or incorrect wiring may cause fire or failure.
- Connectors for external devices or coaxial cables must be crimped or pressed with the tool specified by the manufacturer, or must be correctly soldered. Incomplete connections may cause short circuit, fire, or malfunction.
- Securely connect the connector to the module. Poor contact may cause malfunction.
- Do not install the control lines or communication cables together with the main circuit lines or power cables. Keep a distance of 100 mm or more between them. Failure to do so may result in malfunction due to noise.
- Place the cables in a duct or clamp them. If not, dangling cable may swing or inadvertently be pulled, resulting in damage to the module or cables or malfunction due to poor contact. Do not clamp the extension cables with the jacket stripped.
- Check the interface type and correctly connect the cable. Incorrect wiring (connecting the cable to an incorrect interface) may cause failure of the module and external device.
- Tighten the terminal screws or connector screws within the specified torque range. Undertightening can cause drop of the screw, short circuit, fire, or malfunction. Overtightening can damage the screw and/or module, resulting in drop, short circuit, fire, or malfunction.
- When disconnecting the cable from the module, do not pull the cable by the cable part. For the cable with connector, hold the connector part of the cable. For the cable connected to the terminal block, loosen the terminal screw. Pulling the cable connected to the module may result in malfunction or damage to the module or cable.
- Prevent foreign matter such as dust or wire chips from entering the module. Such foreign matter can cause a fire, failure, or malfunction.
- A protective film is attached to the top of the module to prevent foreign matter, such as wire chips, from entering the module during wiring. Do not remove the film during wiring. Remove it for heat dissipation before system operation.
- Mitsubishi programmable controllers must be installed in control panels. Connect the main power supply to the power supply module in the control panel through a relay terminal block. Wiring and replacement of a power supply module must be performed by qualified maintenance personnel with knowledge of protection against electric shock. For wiring, refer to the MELSEC iQ-R Module Configuration Manual.
- For Ethernet cables to be used in the system, select the ones that meet the specifications in the MELSEC iQ-R Ethernet/CC-Link IE User's Manual (Startup). If not, normal data transmission is not guaranteed.

## [Startup and Maintenance Precautions]

### ⚠WARNING

- Do not touch any terminal while power is on. Doing so will cause electric shock or malfunction.
- Correctly connect the battery connector. Do not charge, disassemble, heat, short-circuit, solder, or throw the battery into the fire. Also, do not expose it to liquid or strong shock. Doing so may cause the battery to generate heat, explode, ignite, or leak, resulting in injury or fire.
- Shut off the external power supply (all phases) used in the system before cleaning the module or retightening the terminal screws, connector screws, or module fixing screws. Failure to do so may result in electric shock or cause the module to fail or malfunction.

## [Startup and Maintenance Precautions]

### ⚠CAUTION

- When connecting an external device with a CPU module or intelligent function module to modify data of a running programmable controller, configure an interlock circuit in the program to ensure that the entire system will always operate safely. For other forms of control (such as program modification, parameter change, forced output, or operating status change) of a running programmable controller, read the relevant manuals carefully and ensure that the operation is safe before proceeding. Improper operation may damage machines or cause accidents.
- Especially, when a remote programmable controller is controlled by an external device, immediate action cannot be taken if a problem occurs in the programmable controller due to a communication failure. To prevent this, configure an interlock circuit in the program, and determine corrective actions to be taken between the external device and CPU module in case of a communication failure.
- Do not disassemble or modify the modules. Doing so may cause failure, malfunction, injury, or a fire.
- Use any radio communication device such as a cellular phone or PHS (Personal Handyphone System) more than 25 cm away in all directions from the programmable controller. Failure to do so may cause malfunction.
- Shut off the external power supply (all phases) used in the system before mounting or removing the module. Failure to do so may cause the module to fail or malfunction.
- Tighten the screws within the specified torque range. Undertightening can cause drop of the component or wire, short circuit, or malfunction. Overtightening can damage the screw and/or module, resulting in drop, short circuit, or malfunction.
- After the first use of the product, do not mount/remove the module to/from the base unit, and the terminal block to/from the module, and do not insert/remove the extended SRAM cassette to/from the CPU module more than 50 times (IEC 61131-2 compliant) respectively.
  Exceeding the limit of 50 times may cause malfunction.
- After the first use of the product, do not insert/remove the SD memory card to/from the CPU module more than 500 times. Exceeding the limit may cause malfunction.
- Do not touch the metal terminals on the back side of the SD memory card. Doing so may cause malfunction or failure.
- Do not touch the integrated circuits on the circuit board of an extended SRAM cassette. Doing so may cause malfunction or failure.
- Do not drop or apply shock to the battery to be installed in the module. Doing so may damage the battery, causing the battery fluid to leak inside the battery. If the battery is dropped or any shock is applied to it, dispose of it without using.

## ⚠CAUTION

- Startup and maintenance of a control panel must be performed by qualified maintenance personnel with knowledge of protection against electric shock. Lock the control panel so that only qualified maintenance personnel can operate it.
- Before handling the module, touch a conducting object such as a grounded metal to discharge the static electricity from the human body. Failure to do so may cause the module to fail or malfunction.
- Before testing the operation, set a low speed value for the speed limit parameter so that the operation can be stopped immediately upon occurrence of a hazardous condition.
- Confirm and adjust the program and each parameter before operation. Unpredictable movements may occur depending on the machine.
- When using the absolute position system function, on starting up, and when the module or absolute value motor has been replaced, always perform a home position return.
- Before starting the operation, confirm the brake function.
- Do not perform a megger test (insulation resistance measurement) during inspection.
- After maintenance and inspections are completed, confirm that the position detection of the absolute position detection function is correct.
- Lock the control panel and prevent access to those who are not certified to handle or install electric equipment.

# [Operating Precautions]

## ⚠CAUTION

- When changing data and operating status, and modifying program of the running programmable controller from an external device such as a personal computer connected to an intelligent function module, read relevant manuals carefully and ensure the safety before operation. Incorrect change or modification may cause system malfunction, damage to the machines, or accidents.
- Do not power off the programmable controller or reset the CPU module while the setting values in the buffer memory are being written to the flash ROM in the module. Doing so will make the data in the flash ROM undefined. The values need to be set in the buffer memory and written to the flash ROM again. Doing so also can cause malfunction or failure of the module.
- Note that when the reference axis speed is specified for interpolation operation, the speed of the partner axis (2nd, 3rd, or 4th axis) may exceed the speed limit value.
- Do not go near the machine during test operations or during operations such as teaching. Doing so may lead to injuries.

# [Disposal Precautions]

## ⚠CAUTION

- When disposing of this product, treat it as industrial waste.
- When disposing of batteries, separate them from other wastes according to the local regulations. For details on battery regulations in EU member states, refer to the MELSEC iQ-R Module Configuration Manual.

## [Transportation Precautions]

### ⚠CAUTION

- When transporting lithium batteries, follow the transportation regulations. For details on the regulated models, refer to the MELSEC iQ-R Module Configuration Manual.
- The halogens (such as fluorine, chlorine, bromine, and iodine), which are contained in a fumigant used for disinfection and pest control of wood packaging materials, may cause failure of the product. Prevent the entry of fumigant residues into the product or consider other methods (such as heat treatment) instead of fumigation. The disinfection and pest control measures must be applied to unprocessed raw wood.

# CONDITIONS OF USE FOR THE PRODUCT

(1) Mitsubishi programmable controller ("the PRODUCT") shall be used in conditions;
i) where any problem, fault or failure occurring in the PRODUCT, if any, shall not lead to any major or serious accident; and
ii) where the backup and fail-safe function are systematically or automatically provided outside of the PRODUCT for the case of any problem, fault or failure occurring in the PRODUCT.

(2) The PRODUCT has been designed and manufactured for the purpose of being used in general industries.
MITSUBISHI SHALL HAVE NO RESPONSIBILITY OR LIABILITY (INCLUDING, BUT NOT LIMITED TO ANY AND ALL RESPONSIBILITY OR LIABILITY BASED ON CONTRACT, WARRANTY, TORT, PRODUCT LIABILITY) FOR ANY INJURY OR DEATH TO PERSONS OR LOSS OR DAMAGE TO PROPERTY CAUSED BY the PRODUCT THAT ARE OPERATED OR USED IN APPLICATION NOT INTENDED OR EXCLUDED BY INSTRUCTIONS, PRECAUTIONS, OR WARNING CONTAINED IN MITSUBISHI'S USER, INSTRUCTION AND/OR SAFETY MANUALS, TECHNICAL BULLETINS AND GUIDELINES FOR the PRODUCT.
("Prohibited Application")
Prohibited Applications include, but not limited to, the use of the PRODUCT in;
- Nuclear Power Plants and any other power plants operated by Power companies, and/or any other cases in which the public could be affected if any problem or fault occurs in the PRODUCT.
- Railway companies or Public service purposes, and/or any other cases in which establishment of a special quality assurance system is required by the Purchaser or End User.
- Aircraft or Aerospace, Medical applications, Train equipment, transport equipment such as Elevator and Escalator, Incineration and Fuel devices, Vehicles, Manned transportation, Equipment for Recreation and Amusement, and Safety devices, handling of Nuclear or Hazardous Materials or Chemicals, Mining and Drilling, and/or other applications where there is a significant risk of injury to the public or property.

Notwithstanding the above, restrictions Mitsubishi may in its sole discretion, authorize use of the PRODUCT in one or more of the Prohibited Applications, provided that the usage of the PRODUCT is limited only for the specific applications agreed to by Mitsubishi and provided further that no special quality assurance or fail-safe, redundant or other safety features which exceed the general specifications of the PRODUCTs are required. For details, please contact the Mitsubishi representative in your region.

# INTRODUCTION

Thank you for purchasing the Mitsubishi MELSEC iQ-R series programmable controllers.
This manual describes the functions and programming of the relevant products listed below. Before using this product, please read this manual and the relevant manuals carefully and develop familiarity with the functions and performance of the MELSEC iQ-R series programmable controller to handle the product correctly.
When applying the program examples provided in this manual to an actual system, ensure the applicability and confirm that it will not cause system control problems.
Please make sure that the end users read this manual.

## Relevant products

RD77MS2, RD77MS4, RD77MS8, RD77MS16

**Point**

In this manual, buffer memories are classified using the following symbols. Each area name can represent the buffer memories corresponding to each axis.
- [Pr.**]: Symbols indicating positioning parameter or home position return parameter items
- [Da.**]: Symbols indicating positioning data or block start data items
- [Md.**]: Symbols indicating monitor data items
- [Cd.**]: Symbols indicating control data items

# COMPLIANCE WITH EMC AND LOW VOLTAGE DIRECTIVES

## Method of ensuring compliance

To ensure that Mitsubishi programmable controllers maintain EMC and Low Voltage Directives when incorporated into other machinery or equipment, certain measures may be necessary. Please refer to one of the following manuals.

📖MELSEC iQ-R Module Configuration Manual

📖Safety Guidelines (This manual is included with the base unit.)

The CE mark on the side of the programmable controller indicates compliance with EMC and Low Voltage Directives.

## Additional measures

To ensure that this product maintains EMC and Low Voltage Directives, please refer to one of the following manuals.

📖MELSEC iQ-R Module Configuration Manual

📖Safety Guidelines (This manual is included with the base unit.)

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# RELEVANT MANUALS

| Manual name [manual number] | Description | Available form |
|---|---|---|
| MELSEC iQ-R Simple Motion Module User's Manual (Application)<br>[IB-0300247] (This manual) | Functions, input/output signals, buffer memories, parameter settings, programming, and troubleshooting of the Simple Motion module | Print book |
| | | e-Manual<br>EPUB<br>PDF |
| MELSEC iQ-R Simple Motion Module User's Manual (Advanced Synchronous Control)<br>[IB-0300249] | Functions and programming for the synchronous control of the Simple Motion module | Print book |
| | | e-Manual<br>EPUB<br>PDF |
| MELSEC iQ-R Simple Motion Module User's Manual (Startup)<br>[IB-0300245] | Specifications, procedures before operation, system configuration, wiring, and operation examples of the Simple Motion module | Print book |
| | | e-Manual<br>EPUB<br>PDF |

This manual does not include information on the module function blocks.

For details, refer to the Function Block Reference for the module used.

**Point**

e-Manual refers to the Mitsubishi FA electronic book manuals that can be browsed using a dedicated tool.

e-Manual has the following features:

- Required information can be cross-searched in multiple manuals.
- Other manuals can be accessed from the links in the manual.
- The hardware specifications of each part can be found from the product figures.
- Pages that users often browse can be bookmarked.

# TERMS

Unless otherwise specified, this manual uses the following terms.

| Term | Description |
|---|---|
| CPU module | Abbreviation for the MELSEC iQ-R series CPU module. |
| Simple Motion module | Abbreviation for the MELSEC iQ-R series Simple Motion module. |
| RD77MS | Another term for the MELSEC iQ-R series Simple Motion module. |
| Servo amplifier | Abbreviation for SSCNETⅢ/H and SSCNETⅢ compatible servo amplifier. |
| MR-J4(W)-B | MR-J4-_B/MR-J4W_-_B Servo amplifier series |
| MR-J3(W)-B | MR-J3-_B/MR-J3W-_B Servo amplifier series |
| MR-JE-B | MR-JE-_B Servo amplifier series |
| Engineering tool | Generic term for GX Works3 and MR Configurator2. |
| GX Works3 | Product name of the software package for the MELSEC programmable controllers. |
| MR Configurator2 | Product name of the setup software for the servo amplifier (Version 1.27D or later). |
| Intelligent function module | A MELSEC iQ-R series module that has functions other than input or output, such as A/D converter module and D/A converter module |
| Manual pulse generator | Abbreviation for manual pulse generator (prepared by user). |
| SSCNETⅢ/H[*1] | High speed synchronous communication network between RD77MS and servo amplifier. |
| SSCNETⅢ[*1] | |
| SSCNETⅢ(/H) | Generic term for SSCNETⅢ/H, SSCNETⅢ. |
| Servo network | |
| 2-axis module | Generic term for RD77MS2. |
| 4-axis module | Generic term for RD77MS4. |
| 8-axis module | Generic term for RD77MS8. |
| 16-axis module | Generic term for RD77MS16. |

*1 SSCNET: Servo System Controller NETwork

# 1 START AND STOP



This chapter describes start and stop methods of the positioning control for the Simple Motion module.

## 1.1 Start

The Simple Motion module operates the start trigger in each control, and starts the positioning control. The following table shows the start signals for each control. This section describes the start using the positioning start signal [Y10 to Y1F] and the external command signal.

| Control details | | Start trigger |
|---|---|---|
| Major positioning control | | • Turns ON the positioning start signal [Y10 to Y1F].<br>• Turns ON the external command signal (DI). |
| High-level positioning control | | |
| Home position return control | | |
| Manual control | JOG operation | Turns ON the "[Cd.181] Forward run JOG start" or the "[Cd.182] Reverse run JOG start". |
| | Inching operation | |
| | Manual pulse generator operation | Operates the manual pulse generator. |

In the control other than the manual control, the following start methods can be selected.

- Normal start (☞ Page 148 Block start)
- Multiple axes simultaneous start (☞ Page 23 Multiple axes simultaneous start)

The positioning data, block start data, and condition data are used for the position specified at the control. The data that can be used varies by the start method.

### Servo ON conditions

Setting of servo parameter

↓

PLC READY signal [Y0] ON

↓

All axis servo ON [Y1] ON

### Starting conditions

To start the control, the following conditions must be satisfied.

The necessary start conditions must be incorporated in the program so that the control is not started when the conditions are not satisfied.

- Operation state

n: Axis No. - 1

| Monitor item | | Operation state | Buffer memory address |
|---|---|---|---|
| [Md.26] | Axis operation status | "0: Standby" or "1: Stopped" | 2409+100n |

• Signal state

| Signal name | | Signal state | | Device |
|---|---|---|---|---|
| I/O signal | PLC READY signal | ON | CPU module preparation completed | Y0 |
| | READY signal | ON | RD77MS preparation completed | X0 |
| | All axis servo ON | ON | All axis servo ON | Y1 |
| | Synchronization flag*1 | ON | The RD77MS buffer memory can be accessed. | X1 |
| | Axis stop signal | OFF | Axis stop signal is OFF | [Cd.180] Axis stop |
| | M code ON signal | OFF | M code ON signal is OFF | [Md.31] Status: b12 |
| | Error detection signal | OFF | There is no error | [Md.31] Status: b13 |
| | BUSY signal | OFF | BUSY signal is OFF | X10 to X1F |
| | Start complete signal | OFF | Start complete signal is OFF | [Md.31] Status: b14 |
| External signal | Forced stop input signal | ON | There is no forced stop input | — |
| | Stop signal | OFF | Stop signal is OFF | — |
| | Upper limit (FLS) | ON | Within limit range | — |
| | Lower limit (RLS) | ON | Within limit range | — |

*1 The interlock must be provided so that the buffer memory is accessed after Synchronization flag [X1] turns on. When no interlock is provided, an unexpected value may be read or written.

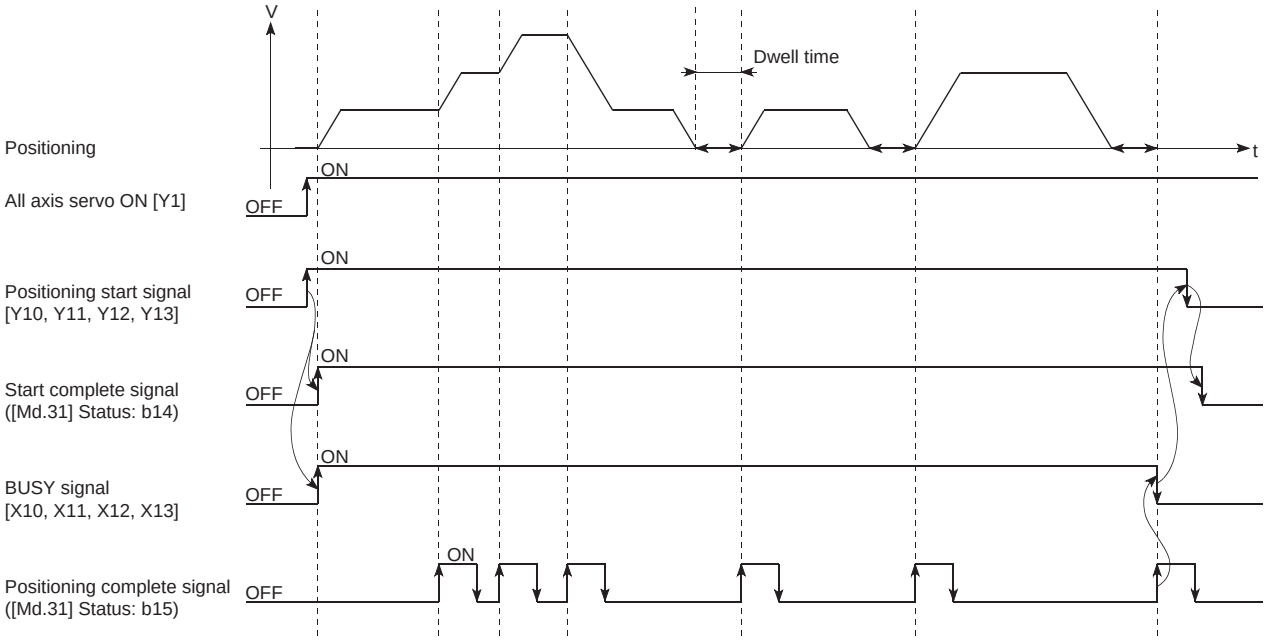
## Start by the positioning start signal [Y10 to Y1F]

The operation at starting by the positioning start signal [Y10 to Y1F] is shown below.

- When the positioning start signal [Y10 to Y1F] turns ON, the start complete signal ([Md.31] Status: b14) and BUSY signal [X10 to X1F] turn ON, and the positioning operation starts. It can be seen that the axis is operating when the BUSY signal [X10 to X1F] is ON.
- When the positioning start signal [Y10 to Y1F] turns OFF, the start complete signal ([Md.31] Status: b14) also turns OFF. If the positioning start signal [Y10 to Y1F] is ON even after positioning is completed, the start complete signal ([Md.31] Status: b14) will remain ON.
- If the positioning start signal turns ON again while the BUSY signal [X10 to X1F] is ON, the warning "Start during operation" (warning code: 0900H)" will occur.
- The process executed when the positioning operation is completed will differ by whether the next positioning control is executed.

| Whether the next positioning control is executed | Processing details |
|---|---|
| Do not execute the positioning | • If a dwell time is set, the system will wait for the set time to pass, and then positioning will be completed.<br>• When positioning is completed, the BUSY signal [X10 to X1F] will turn OFF and the positioning complete signal ([Md.31] Status: b15) will turn ON. However, when using speed control or when the positioning complete signal ON time is "0", the signal will not turn ON.<br>• When the time set in "[Pr.40] Positioning complete signal output time" is passed, the positioning complete signal ([Md.31] Status: b15) will turn OFF. |
| Execute the positioning | • If a dwell time is set, the system will wait for the set time to pass.<br>• When the set dwell time is passed, the next positioning will start. |

### ■RD77MS4 operation example




**Point**

The BUSY signal [X10 to X1F] turns ON even when position control of movement amount 0 is executed. However, since the ON time is short, the ON status may not be detected in the program. (The ON status of the start complete signal ([Md.31] Status: b14), positioning complete signal ([Md.31] Status: b15) and M code ON signal ([Md.31] Status: b12) can be detected in the program.)

## Start by the external command signal (DI)

When starting positioning control by inputting the external command signal (DI), the start command can be directly input into the Simple Motion module. This allows the variation time equivalent to one scan time of the CPU module to be eliminated. This is an effective procedure when operation is to be started as quickly as possible with the start command or when the starting variation time is to be suppressed.

### ■Start method

Set "[Pr.42] External command function selection" in advance to enable "[Cd.8] External command valid" by a program. Then, turn ON the external command signal (DI).

n: Axis No. - 1

| Setting item | | Setting value | Setting details | Buffer memory address |
|---|---|---|---|---|
| [Pr.42] | External command function selection | 0 | Set to "0: External positioning start". | 62+150n |
| [Cd.8] | External command valid | 1 | Set to "1: Validate external command". | 4305+100n |

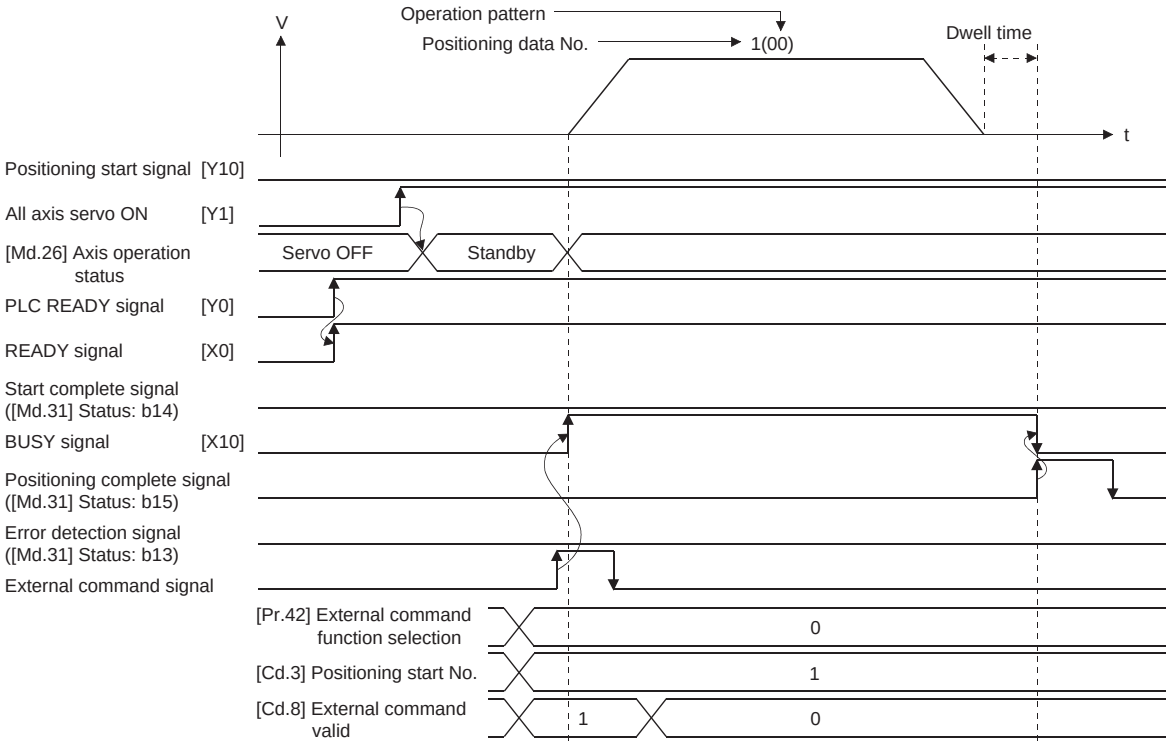
*1 Set the external command signal (DI) to be used in "[Pr.95] External command signal".
Refer to the followings for the setting details.
☞ Page 407 Basic Setting, Page 504 Control Data

### ■Restriction

When starting by inputting the external command signal (DI), the start complete signal ([Md.31] Status: b14) will not turn ON.

### ■Starting time chart

• RD77MS4 operation example



# Multiple axes simultaneous start



The "multiple axes simultaneous start" starts outputting the command to the specified simultaneous starting axis at the same timing as the started axis. The maximum of four axes can be started simultaneously.

## Control details

The multiple axes simultaneous start control is carried out by setting the simultaneous start setting data to the multiple axes simultaneous start control buffer memory of the axis control data, "9004" to "[Cd.3] Positioning start No." of the start axis, and then turning ON the positioning start signal.

Set the number of axes to be started simultaneously and axis No. in "[Cd.43] Simultaneous starting axis", and the start data No. of simultaneous starting axis (positioning data No. to be started simultaneously for each axis) in "[Cd.30] Simultaneous starting own axis start data No." and "[Cd.31] Simultaneous starting axis start data No.1" to "[Cd.33] Simultaneous starting axis start data No.3".

## Restrictions

- The error "Error before simultaneous start" (error code: 1990H, 1991H) will occur and all simultaneously started axes will not start if the simultaneously started axis start data No. is not set to the axis control data on the start axis or set outside the setting range.
- The error "Error before simultaneous start" (error code: 1990H, 1991H) will occur and all simultaneously started axes will not start if either of the simultaneously started axes is BUSY.
- The error "Error before simultaneous start" (error code: 1990H, 1991H) will occur and all simultaneously started axes will not start if an error occurs during the analysis of the positioning data on the simultaneously started axes.
- No error or warning will occur if only the start axis is the simultaneously started axis.
- This function cannot be used with the sub function ☞ Page 266 Pre-reading start function.

## Procedure

The procedure for multiple axes simultaneous start control is shown below.

***1.*** Set the following axis control data.

- [Cd.43] Simultaneous starting axis
- [Cd.30] Simultaneous starting own axis start data No.
- [Cd.31] Simultaneous starting axis start data No.1
- [Cd.32] Simultaneous starting axis start data No.2
- [Cd.33] Simultaneous starting axis start data No.3

***2.*** Write [9004] in "[Cd.3] Positioning start No.".

***3.*** Turn ON the positioning start signal to be started.

## Setting method

The following shows the setting of the data used to execute the multiple axes simultaneous start control with positioning start signals (The axis control data on the start axis is set).

n: Axis No. - 1

| Setting item | | Setting value | Setting details | Buffer memory address |
|---|---|---|---|---|
| [Cd.3] | Positioning start No. | 9004 | Set the multiple axes simultaneous start control start No. "9004". | 4300+100n |
| [Cd.43] | Simultaneous starting axis | Set the number of simultaneous starting axes and target axis. | | 4368+100n<br>4369+100n |
| [Cd.30] | Simultaneous starting own axis start data No. | Set the simultaneously started axis start data No. Set a "0" for the axis other than the simultaneously started axes. | | 4340+100n |
| [Cd.31] | Simultaneous starting axis start data No.1 | | | 4341+100n |
| [Cd.32] | Simultaneous starting axis start data No.2 | | | 4342+100n |
| [Cd.33] | Simultaneous starting axis start data No.3 | | | 4343+100n |

*1 Refer to the following for the setting details.
☞ Page 504 Control Data

*2 The signal of axis 3 and 4 cannot be used in the RD77MS2.

## Setting examples

The following shows the setting examples in which the axis 10 is used as the start axis and the axis 12 and axis 14 are used as the simultaneously started axes.

| Setting item | | Setting value | Setting details | Buffer memory address (Axis 10) |
|---|---|---|---|---|
| [Cd.3] | Positioning start No. | 9004 | Set the multiple axes simultaneous start control start No. "9004". | 5200 |
| [Cd.43] | Simultaneous starting axis | 03000D0BH | Set the axis 12 (0BH) to the simultaneously starting axis No.1, and the axis 14 (0DH) to the simultaneously starting axis No.2. | 5268, 5269 |
| [Cd.30] | Simultaneous starting own axis start data No. | 100 | The axis 10 starts the positioning data No. 100. | 5240 |
| [Cd.31] | Simultaneous starting axis start data No.1 | 200 | Immediately after the start of the axis 10, the axis 12 starts the axis 12 positioning data No. 200. | 5241 |
| [Cd.32] | Simultaneous starting axis start data No.2 | 300 | Immediately after the start of the axis 10, the axis 14 starts the axis 14 positioning data No. 300. | 5242 |
| [Cd.33] | Simultaneous starting axis start data No.3 | 0 | Will not start simultaneously. | 5243 |

**Point**

The "multiple axes simultaneous start control" carries out an operation equivalent to the "simultaneous start" using the "block start data".

The setting of the "multiple axes simultaneous start control" is easier than that of the "simultaneous start" using the "block start data".

- Setting items for "simultaneous start" using "block start data": Positioning start data, block start data, condition data, and positioning data
- Setting items for "multiple axes simultaneous start control": Positioning data and axis control data

# 1.2 Stop



The axis stop signal or stop signal from external input signal is used to stop the control.
Create a program to turn ON the axis stop signal [Cd.180] as the stop program.
Each control is stopped in the following cases.

- When each control is completed normally
- When the Servo READY signal is turned OFF
- When a CPU module error occurs
- When the PLC READY signal is turned OFF
- When an error occurs in Simple Motion module
- When control is intentionally stopped (Stop signal from CPU module turned ON, "Stop signal" of external input signal turned ON, etc.)

The stop process for the above cases is shown below.
(Excluding when each control is completed normally.)

## Stop process

| Stop cause | | Stop axis | M code ON signal after stop | Axis operation status after stopping ([Md.26]) |
|---|---|---|---|---|
| Forced stop | "Forced stop input signal" OFF from an external device | All axes | No change | Servo OFF |
| | Servo READY OFF<br>• Servo amplifier power supply OFF | Each axis | No change | Servo amplifier has not been connected |
| | • Servo alarm | | | Error |
| | • Forced stop input to servo amplifier | | | Servo OFF |
| Fatal stop (Stop group 1) | Hardware stroke limit upper/lower limit error occurrence | Each axis | No change | Error |
| Emergency stop (Stop group 2) | Error occurs in a CPU module | All axes | No change | Error |
| | PLC READY signal OFF | | Turns OFF | |
| | Error in test mode | | No change | |
| Relatively safe stop (Stop group 3) | Axis error detection (Error other than stop group 1 or 2)*1 | Each axis | No change | Error |
| | "Stop" input from an engineering tool | | | |
| Intentional stop (Stop group 3) | "Axis stop signal" ON from a CPU module | Each axis | No change | Stopped (Standby) |
| | "Stop signal" of external input signal ON | | | |

*1 If an error occurs in a positioning data due to an invalid setting value, when the continuous positioning control uses multiple positioning data successively, it automatically decelerates at the previous positioning data. It does not stop suddenly even the setting value is sudden stop in stop group 3. If any of the following error occurs, the operation is performed up to the positioning data immediately before the positioning data where an error occurred, and then stops immediately.
No command speed (error code: 1A13H, 1A14H)
Outside linear movement amount range (error code: 1A15H, 1A16H)
Large arc error deviation (error code: 1A17H)
Software stroke limit + (error code: 1A18H, 1A19H)
Software stroke limit - (error code: 1A1AH, 1A1BH)
Sub point setting error (error code: 1A27H, 1A28H, 1A29H, 1A2AH, 1A37H)
End point setting error (error code: 1A2BH, 1A2CH)
Center point setting error (error code: 1A2DH, 1A2EH, 1A2FH)
Outside radius range (error code: 1A32H)
Illegal setting of ABS direction in unit of degree (error code: 19A4H, 19A5H)

| Stop cause | | Stop process | | | | | |
|---|---|---|---|---|---|---|---|
| | | Home position return control | | Major positioning control | High-level positioning control | Manual control | |
| | | Machine home position return control | Fast home position return control | | | JOG/ Inching operation | Manual pulse generator operation |
| Forced stop | "Forced stop input signal" OFF from an external device | Servo OFF or free run<br>(The operation stops with dynamic brake) | | | | | — |
| | Servo READY OFF<br>• Servo amplifier power supply OFF | | | | | | |
| | • Servo alarm | | | | | | |
| | • Forced stop input to servo amplifier | | | | | | |
| Fatal stop<br>(Stop group 1) | Hardware stroke limit upper/lower limit error occurrence | Deceleration stop/sudden stop<br>(Select with "[Pr.37] Stop group 1 sudden stop selection".) | | | | | Deceleration stop |
| Emergency stop<br>(Stop group 2) | Error occurs in a CPU module | Delegation stop/sudden stop<br>(Select with "[Pr.38] Stop group 2 sudden stop selection".) | | | | | Deceleration stop |
| | PLC READY signal OFF | | | | | | |
| | Error in test mode | | | | | | |
| Relatively safe stop<br>(Stop group 3) | Axis error detection (Error other than stop group 1 or 2)*1 | Deceleration stop/sudden stop<br>(Select with "[Pr.39] Stop group 3 sudden stop selection".) | | | | | Deceleration stop |
| | "Stop" input from an engineering tool | | | | | | |
| Intentional stop<br>(Stop group 3) | "Axis stop signal" ON from a CPU module | | | | | | |
| | "Stop signal" of external input signal ON | | | | | | |

*1 If an error occurs in a positioning data due to an invalid setting value, when the continuous positioning control uses multiple positioning data successively, it automatically decelerates at the previous positioning data. It does not stop suddenly even the setting value is sudden stop in stop group 3. If any of the following error occurs, the operation is performed up to the positioning data immediately before the positioning data where an error occurred, and then stops immediately.
No command speed (error code: 1A13H, 1A14H)
Outside linear movement amount range (error code: 1A15H, 1A16H)
Large arc error deviation (error code: 1A17H)
Software stroke limit + (error code: 1A18H, 1A19H)
Software stroke limit - (error code: 1A1AH, 1A1BH)
Sub point setting error (error code: 1A27H, 1A28H, 1A29H, 1A2AH, 1A37H)
End point setting error (error code: 1A2BH, 1A2CH)
Center point setting error (error code: 1A2DH, 1A2EH, 1A2FH)
Outside radius range (error code: 1A32H)
Illegal setting of ABS direction in unit of degree (error code: 19A4H, 19A5H)

## Types of stop processes

The operation can be stopped with deceleration stop, sudden stop or immediate stop.

### ■Deceleration stop

The operation stops with "deceleration time 0 to 3" ([Pr.10], [Pr.28], [Pr.29], [Pr.30]). Which time from "deceleration time 0 to 3" to use for control is set in positioning data ([Da.4]).

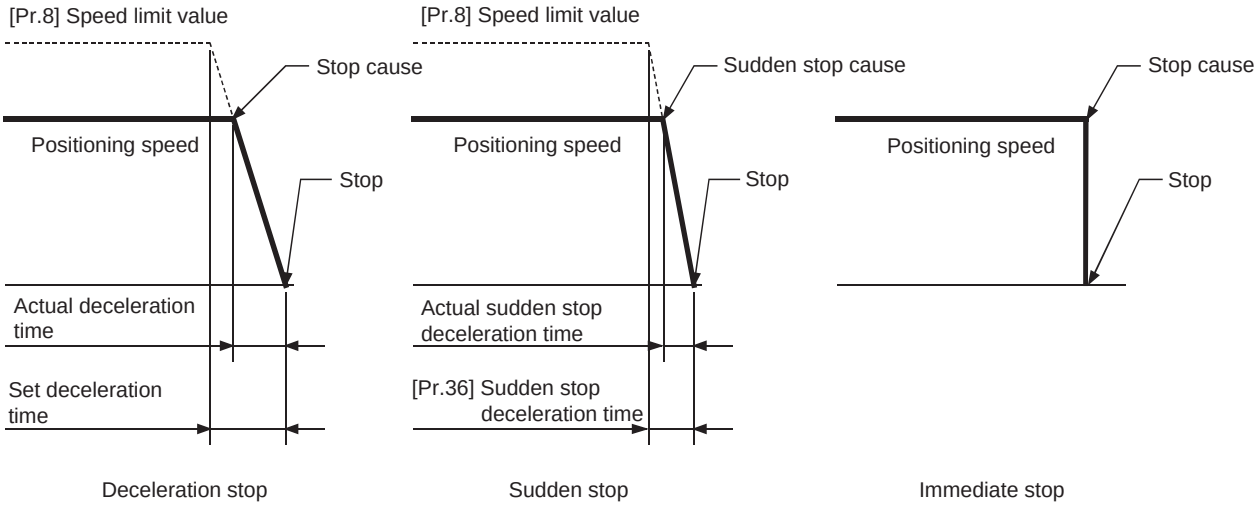
### ■Sudden stop

The operation stops with "[Pr.36] Sudden stop deceleration time".

### ■Immediate stop

The operation does not decelerate.

The Simple Motion module immediately stops the command. For the stop method of the servo amplifier, refer to each servo amplifier instruction manual.




**Point**

"Deceleration stop" and "sudden stop" are selected with the detailed parameter 2 "stop group 1 to 3 sudden stop selection". (The default setting is "deceleration stop".)

## Order of priority for stop process

The order of priority for the Simple Motion module stop process is as follows.

(Deceleration stop) < (Sudden stop) < (Servo OFF)

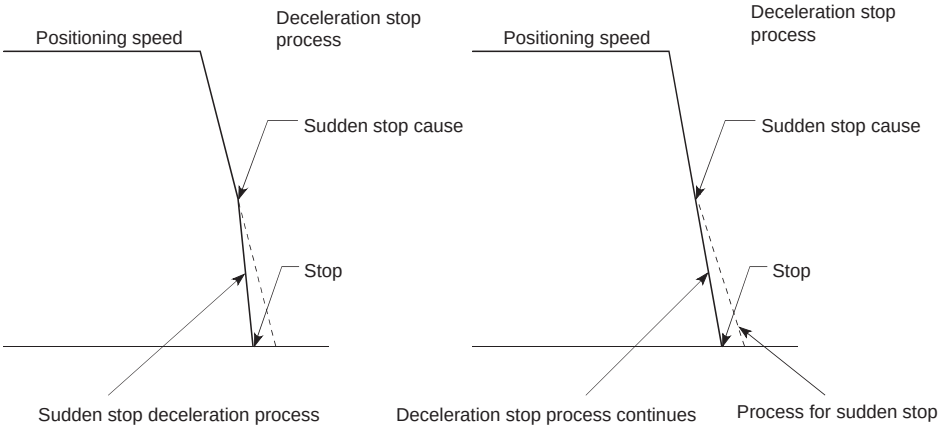
- If the deceleration stop command ON (stop signal ON) or deceleration stop cause occurs during deceleration to speed 0 (including automatic deceleration), operation changes depending on the setting of "[Cd.42] Stop command processing for deceleration stop selection". (☞ Page 269 Stop command processing for deceleration stop function)

| Positioning control during deceleration | Setting value of [Cd.42] | Processing details |
|---|---|---|
| Manual control | — | Independently of the [Cd.42] setting, a deceleration curve is re-processed from the speed at stop cause occurrence. |
| Home position return control, positioning control | 0: Deceleration curve re-processing | A deceleration curve is re-processed from the speed at stop cause occurrence. (☞ Page 269 Deceleration curve re-processing) |
| | 1: Deceleration curve continuation | The current deceleration curve is continued after stop cause occurrence. (☞ Page 269 Deceleration curve continuation) |

- If the stop signal designated for sudden stop turns ON or a stop cause occurs during deceleration, the sudden stop process will start from that point. However, if the sudden stop deceleration time is longer than the deceleration time, the deceleration stop process will be continued even if a sudden stop cause occurs during the deceleration stop process.

Example

The process when a sudden stop cause occurs during deceleration stop is shown below.




(a) When deceleration stop time > sudden stop deceleration time

(b) When deceleration stop time < sudden stop deceleration time

## Inputting the stop signal during deceleration

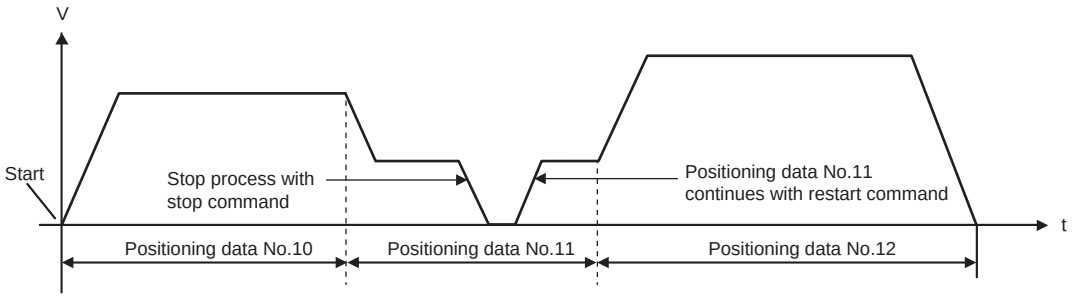
- Even if stop is input during deceleration (including automatic deceleration), the operation will stop at that deceleration speed.
- If stop is input during deceleration for home position return, the operation will stop at that deceleration speed. If input at the creep speed, the operation will stop immediately.
- If a stop cause, designated for sudden stop, occurs during deceleration, the sudden stop process will start from that point. The sudden stop process during deceleration is carried out only when the sudden stop time is shorter than the deceleration stop time.

# 1.3 Restart

When a stop factor occurs during position control and the operation stops, the positioning can be restarted from the stopped position to the position control end point by using the "restart command" ([Cd.6] Restart command). ("Restarting" is not possible when "continuous operation is interrupted.")
This instruction is efficient when performing the remaining positioning from the stopped position in the positioning control of incremental method such as INC linear 1. (Calculation of remaining distance is not required.)

## Operation

After a deceleration stop by the stop command is completed, write "1: Restarts" to the "[Cd.6] Restart command" with "[Md.26] Axis operation status" is "stopped" and the positioning restarts.




## Restrictions

- Restarting can be executed only when the "[Md.26] Axis operation status" is "stopped (the deceleration stop by stop command is completed)". If the axis operation is not "stopped", restarting is not possible. In this case, the warning "Restart not possible" (warning code: 0902H) will occur, and the process at that time will be continued.
- Do not execute restart while the stop command is ON. If restart is executed while stopped, the error "Stop signal ON at start" (error code: 1908H) will occur, and the "[Md.26] Axis operation status" will change to "Error". Thus, even if the error is reset, the operation cannot be restarted.
- Restarting can be executed even while the positioning start signal is ON. However, make sure that the positioning start signal does not change from OFF to ON while stopped.
- If the positioning start signal is changed from OFF to ON while "[Md.26] Axis operation status" is "stopped", the normal positioning (the positioning data set in "[Cd.3] Positioning start No.") is started.
- If positioning is ended with the continuous operation interrupt request, the operation cannot be restarted. If restart is requested, the warning "Restart not possible" (warning code: 0902H) will occur.
- When stopped with interpolation operation, write "1: Restarts" into "[Cd.6] Restart command" for the reference axis, and then restart.
- If the PLC READY signal is changed from OFF to ON while stopped, restarting is not possible. If restart is requested, the warning "Restart not possible" (warning code: 0902H) will occur.
- When the machine home position return and fast home position return is stopped, the error "Home position return restart not possible" (error code: 1946H) will occur and the positioning cannot restarts.
- If any of reference partner axes executes the positioning operation once after interpolation operation stop, the warning "Restart not possible" (warning code: 0902H) will occur, and the positioning cannot restarts.

## Setting method

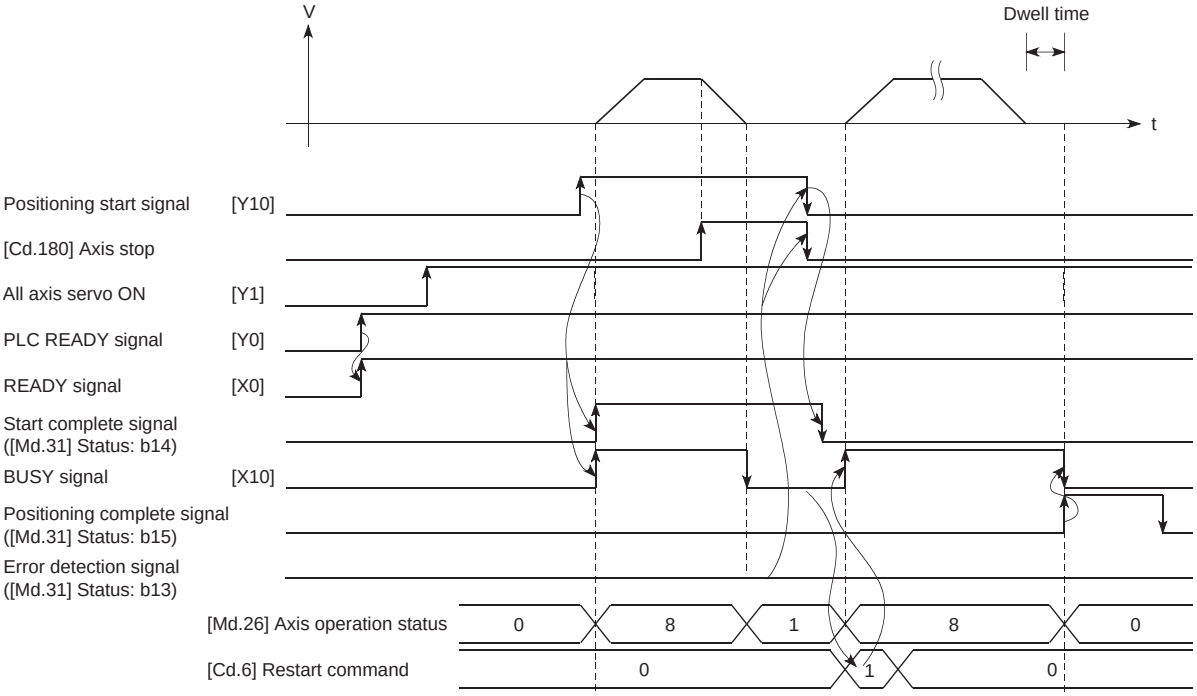
Set the following data to execute restart.
n: Axis No. - 1

| Setting item | | Setting value | Setting details | Buffer memory address |
|---|---|---|---|---|
| [Cd.6] | Restart command | 1 | Set "1: Restarts". | 4303+100n |

*1 Refer to the following for the setting details.
☞ Page 504 Control Data

## Time chart for restarting

### ■RD77MS4 operation example




## Program example

Refer to the following for the program example of restart.

☞ Page 571 Restart program

# 2 HOME POSITION RETURN CONTROL

The details and usage of "home position return control" are explained in this chapter.



## 2.1 Outline of Home Position Return Control

### Two types of home position return control

In "home position return control", a position is established as the starting point (or "home position") when carrying out positioning control, and positioning is carried out toward that starting point.
It is used to return a machine system at any position other than the home position to the home position when the Simple Motion module issues a "home position return request" with the power turned ON or others, or after a positioning stop.
In the Simple Motion module, the following two control types are defined as "home position return control", following the flow of the home position return work. These two types of home position return control can be executed by setting the "home position return parameters", setting "Positioning start No. 9001" and "positioning start No. 9002" prepared beforehand in the Simple Motion module to "[Cd.3] Positioning start No.", and turning ON the positioning start signal.

| Home position return method | Home position return method operation details |
|---|---|
| Machine home position return (positioning start No. 9001) | Executes the home position return operation to establish a machine home position. The following positioning control is executed based on the home position established by the home position return completion. The machine home position return is required when the machine home position has not been established (the current value monitor of the Simple Motion module and the actual machine position are not matched) due to the power supply ON of the system, etc. |
| Fast home position return (positioning start No. 9002) | Executes the positioning to the home position established by a machine home position return. The fast home position return is operated by specifying the positioning start No.9002, so that the positioning which returns to the home position can be executed without setting the positioning data. |

The "machine home position return" above must be carried out in advance to execute the "fast home position return".

**⚠CAUTION**

- When using an absolute position system, execute a home position return always at the following cases: on starting up and when the controller or absolute value motor has been replaced. Check the home position return request signal using the program, etc. before performing the positioning control. Failure to observe this could lead to an accident such as a collision.

The address information stored in the Simple Motion module cannot be guaranteed while the "home position return request flag" is ON.
The "home position return request flag" turns OFF and the "home position return complete flag" ([Md.31] Status: b4) turns ON if the machine home position return is executed and is completed normally.
The "home position return request flag" ([Md.31] Status: b3) must be turned ON in the Simple Motion module, and a machine home position return must be executed in the following cases.

#### When not using an absolute position system

- This flag turns on in the following cases:
  - System's power supply on or reset
  - Servo amplifier power supply on
  - Machine home position return start (Unless a machine home position return is completed normally, the home position return request flag does not turn off.)
- This flag turns off by the completion of machine home position return.

## When using an absolute position system

• This flag turns on in the following cases:

• When not executing a machine home position return even once after the system starts
• Machine home position return start (Unless a machine home position return is completed normally, the home position return request flag does not turn off.)
• When an absolute position data in the Simple Motion module is erased due to a battery error, etc. (occurrence of the warning "Home position return data incorrect" (warning code: 093CH))
• When the "Rotation direction selection/travel direction selection (PA14)" of servo parameter is changed.
• The servo alarm "Absolute position erased" (alarm No.: 25) occurs. ([Md.108] Servo status1: b14 ON)
• The servo warning "Absolute position counter warning" (warning No.: E3) occurs. ([Md.108] Servo status1: b14 ON)

n: Axis No. - 1

| Monitor item | Buffer memory address |
|---|---|
| [Md.108] Servo status1: b14 | 2477+100n |

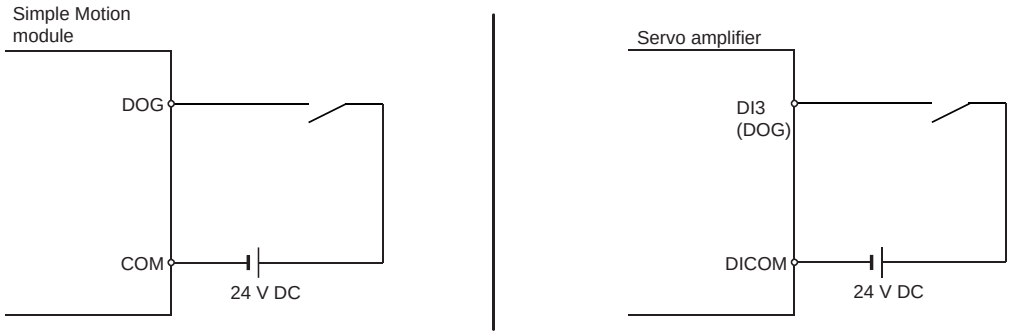
• This flag turns off by the completion of the machine home position return.

## Wiring the near-point dog

The "external input signal of the Simple Motion module", "external input signal of the servo amplifier" or "buffer memory of the Simple Motion module" can be selected by "[Pr.118] DOG signal selection" as the near-point dog.

When the "buffer memory of the Simple Motion module" is selected, the wiring differs according to the Input module used. As for the 24 V DC power supply, the direction of current can be switched.

*1 When "Servo amplifier" is set in "[Pr.116] FLS signal selection" to "[Pr.118] DOG signal selection" at MR-JE-B use, any errors or warnings do not occur. However, the external input signal (upper/lower limit signal, near-point dog signal) cannot be operated.




## Home position return sub functions

Refer to the following for details on "sub functions" that can be combined with home position return control.

MELSEC iQ-R Simple Motion Module User's Manual (Startup)

Also refer to the following for details on each sub function.

☞ Page 215 CONTROL SUB FUNCTIONS

[Remarks]

The following two sub functions are only related to machine home position return.

○: Combination possible, △: Restricted, ×: Combination not possible

| Sub function name | Machine home position return | Fast home position return | Reference |
|---|---|---|---|
| Home position return retry function | △ | × | ☞ Page 217 Home position return retry function |
| Home position shift function | ○ | × | ☞ Page 221 Home position shift function |

## When a home position return is not required

Control can be carried out ignoring the "home position return request flag" ([Md.31] Status: b3) in systems that do not require a home position return.

In this case, the "home position return parameters ([Pr.43] to [Pr.57])" must all be set to their initial values or a value at which an error does not occur.

# 2.2 Machine Home Position Return

## Outline of the machine home position return operation



**Point**

Use the home position return retry function when the home position is not always in the same direction from the workpiece operation area (when the home position is not set near the upper or lower limit of the machine). The machine home position return may not complete unless the home position return retry function is used.

### Machine home position return operation

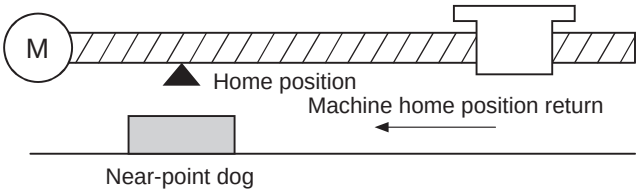
In a machine home position return, a home position is established.

None of the address information stored in the Simple Motion module, CPU module, or servo amplifier is used at this time.

The position mechanically established after the machine home position return is regarded as the "home position" to be the starting point for positioning control.

The method for establishing a home position by a machine home position return differs according to the method set in "[Pr.43] Home position return method".

The following shows the operation when starting a machine home position return.




1. The "machine home position return" is started.
2. The operation starts according to the speed and direction set in the home position return parameters ([Pr.43] to [Pr.57]).
3. The "home position" is established by the method set in "[Pr.43] Home position return method", and the machine stops.

☞ Page 34 Machine home position return method to Page 42 Scale origin signal detection method

4. If "a" is set as "[Pr.45] Home position address", "a" will be stored as the current position in the "[Md.20] Current feed value" and "[Md.21] Machine feed value" which are monitoring the position.
5. The machine home position return is completed.

# Machine home position return method

The method by which the machine home position is established (method for judging the home position and machine home position return completion) is designated in the machine home position return according to the configuration and application of the positioning method.

The following table shows the methods that can be used for this home position return method. (The home position return method is one of the items set in the home position return parameters. It is set in "[Pr.43] Home position return method" of the basic parameters for home position return.)

| [Pr.43] Home position return method | Operation details |
|---|---|
| Near-point dog method | Deceleration starts by the OFF → ON of the near-point dog. (Speed is reduced to "[Pr.47] Creep speed".)<br>The operation stops once after the near-point dog turns ON and then OFF. Later the operation restarts and then stops at the first zero signal to complete the home position return.<br>That position is assumed as a home position. |
| Count method 1 | The deceleration starts by the OFF → ON of the near-point dog, and the machine moves at the "[Pr.47] Creep speed". The machine stops once after moving the distance set in the "[Pr.50] Setting for the movement amount after near-point dog ON" from the OFF → ON position. Later the operation restarts and then stops at the first zero point to complete the machine home position return. |
| Count method 2 | The deceleration starts by the OFF → ON of the near-point dog, and the machine moves at the "[Pr.47] Creep speed. The machine moves the distance set in the "[Pr.50] Setting for the movement amount after near-point dog ON" from the near-point dog OFF → ON position, and stops at that position. The machine home position return is then regarded as completed. |
| Data set method | The position where the machine home position return has been performed becomes a home position.<br>The current feed value and feed machine value are overwritten to the home position address. |
| Scale origin signal detection method | The machine moves in the opposite direction against of "[Pr.44] Home position return direction" at the "[Pr.46] Home position return speed" by the OFF → ON of the near-point dog, and a deceleration stop is carried out once at the first zero signal. Later the operation moves in direction of "[Pr.44] Home position return direction" at the "[Pr.47] Creep speed", and then stops at the detected nearest zero point to complete the machine home position return. |

The following shows the signals used for machine home position return.

◎: Necessary, ○: Necessary as required, —: Unnecessary

| [Pr.43] Home position return method | Signals required for control | | |
|---|---|---|---|
| | Near-point dog | Zero signal | Upper/lower limit |
| Near-point dog method | ◎ | ◎ | ○ |
| Count method 1 | ◎ | ◎ | ○ |
| Count method 2 | ◎ | — | ○ |
| Data set method | — | — | — |
| Scale origin signal detection method | ◎ | ◎ | — |

**Point**

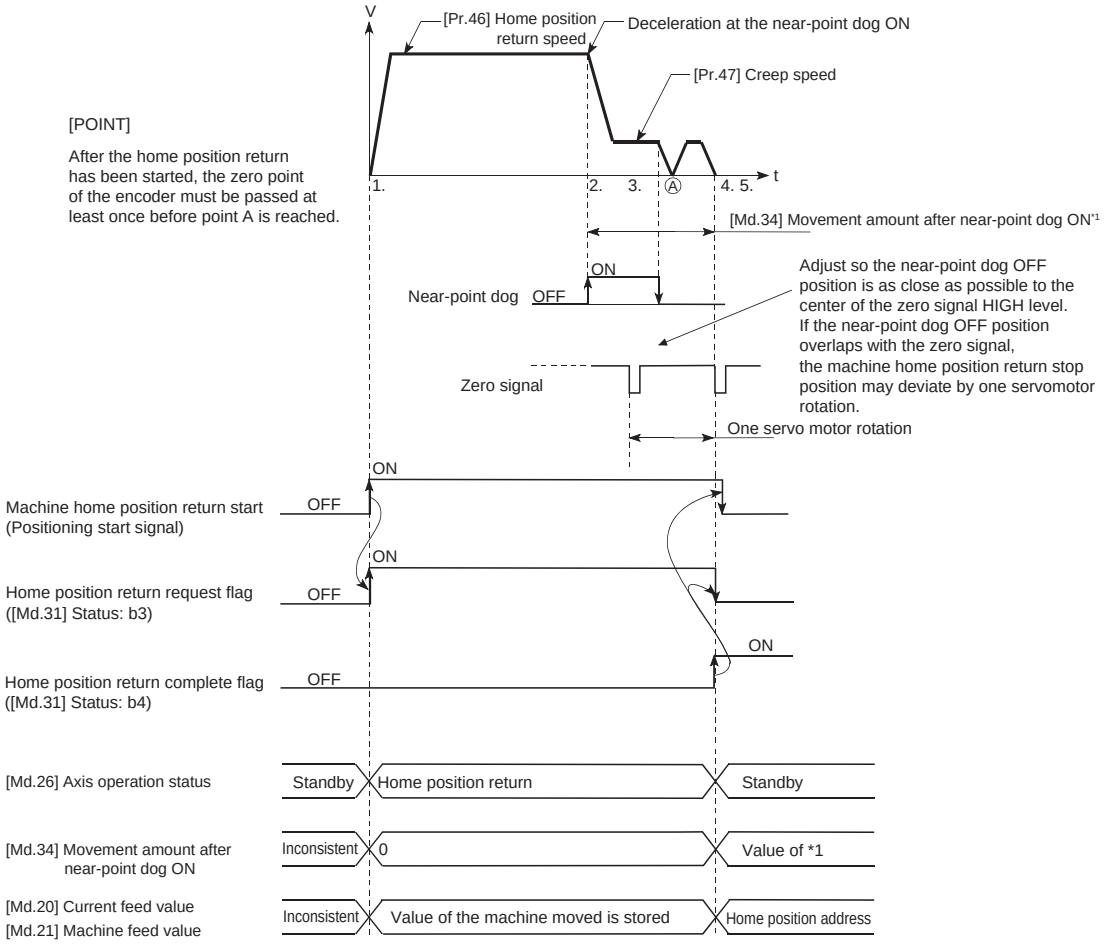
Creep speed

The stopping accuracy is poor when the machine suddenly stops from fast speeds. To improve the machine's stopping accuracy, it is required to slow down the speed before it stops. This speed is set in the "[Pr.47] Creep speed".

# Near-point dog method

The following shows an operation outline of the home position return method "near-point dog method".

## Operation chart


V
[Pr.46] Home position return speed
Deceleration at the near-point dog ON
[Pr.47] Creep speed
[POINT]
After the home position return has been started, the zero point of the encoder must be passed at least once before point A is reached.
1.
2.
3.
A
4.
5.
t
[Md.34] Movement amount after near-point dog ON*1
ON
Near-point dog
OFF
Adjust so the near-point dog OFF position is as close as possible to the center of the zero signal HIGH level. If the near-point dog OFF position overlaps with the zero signal, the machine home position return stop position may deviate by one servomotor rotation.
Zero signal
One servo motor rotation
Machine home position return start (Positioning start signal)
Home position return request flag ([Md.31] Status: b3)
Home position return complete flag ([Md.31] Status: b4)
[Md.26] Axis operation status
Standby
Home position return
Standby
[Md.34] Movement amount after near-point dog ON
Inconsistent
0
Value of *1
[Md.20] Current feed value
[Md.21] Machine feed value
Inconsistent
Value of the machine moved is stored
Home position address

***1.*** The machine home position return is started.

(The machine begins the acceleration designated in "[Pr.51] Home position return acceleration time selection", in the direction designated in "[Pr.44] Home position return direction". It then moves at the "[Pr.46] Home position return speed" when the acceleration is completed.)

***2.*** The machine begins decelerating when the near-point dog ON is detected.

***3.*** The machine decelerates to the "[Pr.47] Creep speed", and subsequently moves at that speed.

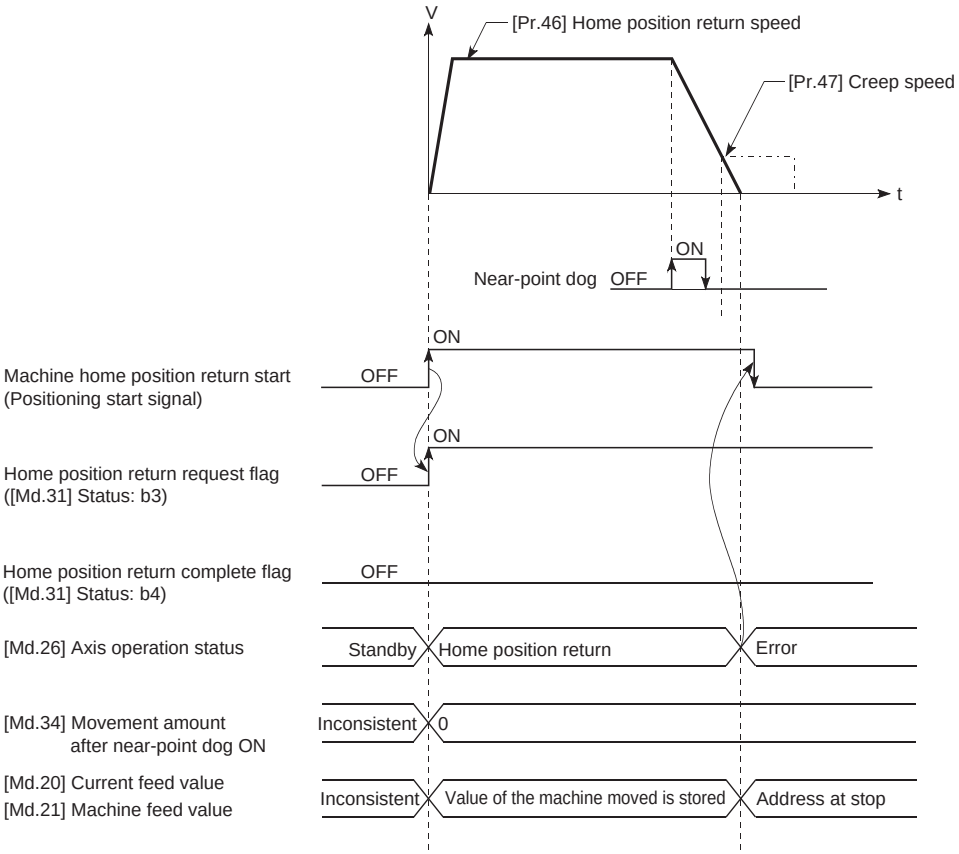
(At this time, the near-point dog must be ON. The workpiece will continue decelerating and stop if the near-point dog is OFF.)

***4.*** After the near-point dog turns OFF, the machine stops. It then restarts and stops at the first zero point.

***5.*** The home position return complete flag ([Md.31] Status: b4) turns from OFF to ON and the home position return request flag ([Md.31] Status: b3) turns from ON to OFF.

## Precautions during operation

- When the home position return retry function is not set ("0" is set in "[Pr.48] Home position return retry"), the error "Start at home position" (error code: 1940H) will occur if the machine home position return is attempted again after the machine home position return completion.
- Machine home position return carried out from the near-point dog ON position will start at the "[Pr.47] Creep speed".
- The near-point dog must be ON during deceleration from the home position return speed "[Pr.47] Creep speed".
- When the stop signal stops the machine home position return, carry out the machine home position return again. When restart command is turned ON after the stop signal stops the home position return, the error "Home position return restart not possible" (error code: 1946H) will occur.
- After the home position return has been started, the zero point of the encoder must be passed at least once before point A is reached. However, if selecting "1: Not need to pass servo motor Z-phase after power on" with "Function selection C-4 (PC17)", it is possible to carry out the home position return without passing the zero point. The workpiece will continue decelerating and stop if the near-point dog is turned OFF before it has decelerated to the creep speed, thus causing the error "Dog detection timing fault" (error code: 1941H).



# Count method1

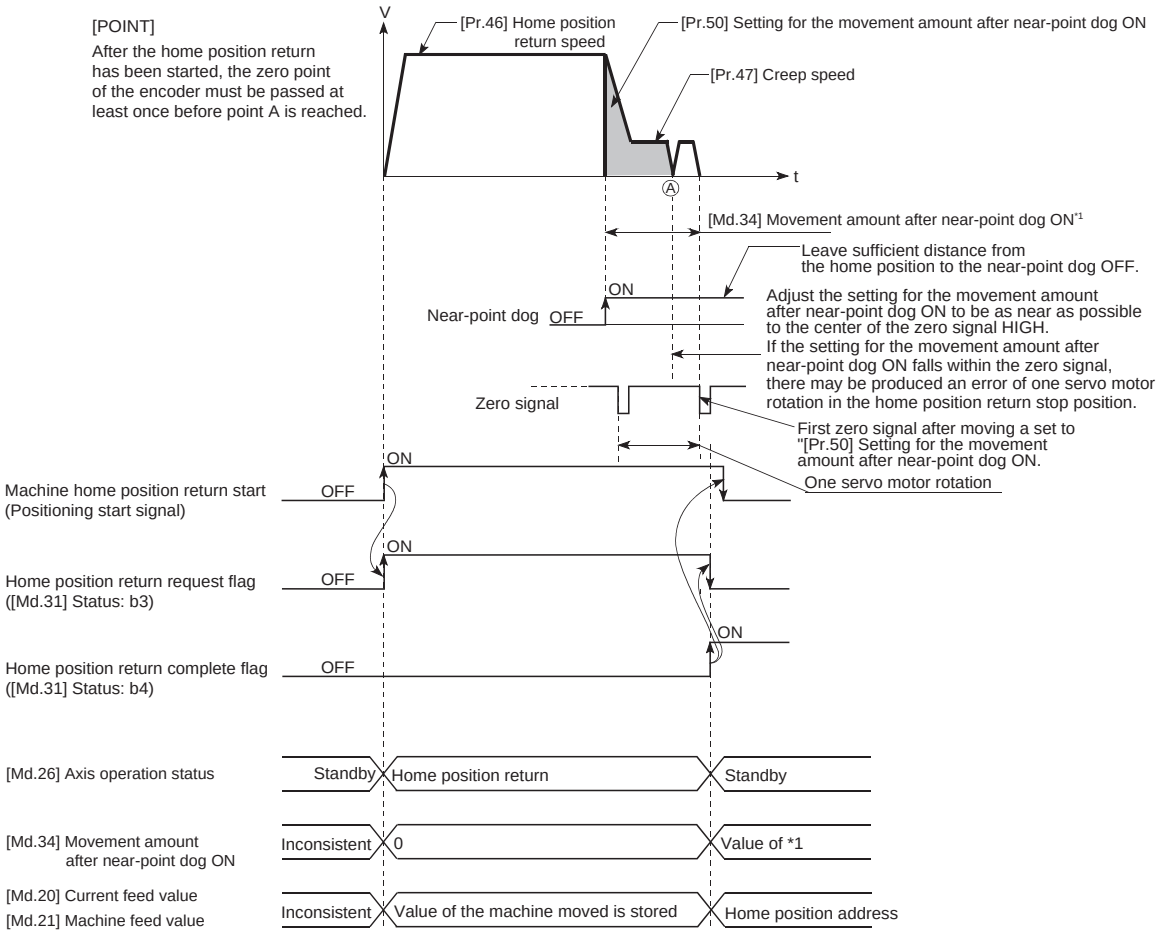
The following shows an operation outline of the home position return method "count method 1".

In the "count method 1", the machine home position return can be performed in the following cases:

- Where the near-point dog is on
- After the machine home position return is completed



## Operation chart


[POINT]
After the home position return has been started, the zero point of the encoder must be passed at least once before point A is reached.
V
[Pr.46] Home position return speed
[Pr.50] Setting for the movement amount after near-point dog ON
[Pr.47] Creep speed
t
A
[Md.34] Movement amount after near-point dog ON*1
Leave sufficient distance from the home position to the near-point dog OFF.
ON
Near-point dog OFF
Adjust the setting for the movement amount after near-point dog ON to be as near as possible to the center of the zero signal HIGH.
If the setting for the movement amount after near-point dog ON falls within the zero signal, there may be produced an error of one servo motor rotation in the home position return stop position.
Zero signal
First zero signal after moving a set to "[Pr.50] Setting for the movement amount after near-point dog ON.
One servo motor rotation
Machine home position return start (Positioning start signal)
Home position return request flag ([Md.31] Status: b3)
Home position return complete flag ([Md.31] Status: b4)
[Md.26] Axis operation status
Standby
Home position return
Standby
[Md.34] Movement amount after near-point dog ON
Inconsistent
0
Value of *1
[Md.20] Current feed value
[Md.21] Machine feed value
Inconsistent
Value of the machine moved is stored
Home position address

***1.*** The machine home position return is started.

(The machine begins the acceleration designated in "[Pr.51] Home position return acceleration time selection", in the direction designated in "[Pr.44] Home position return direction". It then moves at the "[Pr.46] Home position return speed" when the acceleration is completed.)

***2.*** The machine begins decelerating when the near-point dog ON is detected.

***3.*** The machine decelerates to the "[Pr.47] Creep speed", and subsequently moves at that speed.

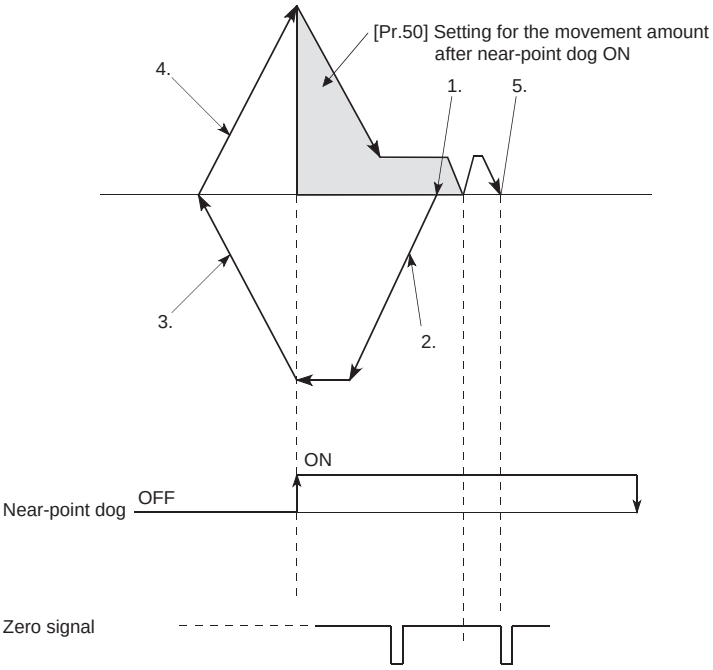
***4.*** The machine stops after the workpiece has been moved the amount set in the "[Pr.50] Setting for the movement amount after near-point dog ON" after the near-point dog turned ON. It then restarts and stops at the first zero point.

***5.*** The home position return complete flag ([Md.31] Status: b4) turns from OFF to ON, and the home position return request flag ([Md.31] Status: b3) turns from ON to OFF.

## Precautions during operation

- The error "Count method movement amount fault" (error code: 1944H) will occur if the "[Pr.50] Setting for the movement amount after near-point dog ON" is smaller than the deceleration distance from the "[Pr.46] Home position return speed" to "[Pr.47] Creep speed".
- If the speed is changed to a speed faster than "[Pr.46] Home position return speed" by the speed change function (☞ Page 248 Speed change function) during a machine home position return, the distance to decelerate to "[Pr.47] Creep speed" may not be ensured, depending on the setting value of "[Pr.50] Setting for the movement amount after near-point dog ON". In this case, the error "Count method movement amount fault" (error code: 1944H) occurs and the machine home position return is stopped.
- The following shows the operation when a machine home position return is started while the near-point dog is ON.

### ■Operation when a machine home position return is started at the near-point dog ON position




***1.*** A machine home position return is started.

***2.*** The machine moves at the home position return speed in the opposite direction of a home position return.

***3.*** Deceleration processing is carried out when the near-point dog OFF is detected.

***4.*** After the machine stops, a machine home position return is carried out in the home position return direction.

***5.*** The machine home position return is completed on detection of the first zero signal after the travel of the movement amount set to "[Pr.50] Setting for the movement amount after near-point dog ON" on detection of the near-point dog signal ON.

- Turn OFF the near-point dog at a sufficient distance from the Home position. Although there is no harm in operation if the near-point dog is turned OFF during a machine home position return, it is recommended to leave a sufficient distance from the home position when the near-point dog is turned OFF for the following reason.

If the machine home position return is performed consecutively after the near-point dog is turned OFF at the time of machine home position return completion, operation will be performed at the home position return speed until the hardware stroke limit (upper/lower limit) is reached. If a sufficient distance cannot be kept, consider the use of the home position return retry function.

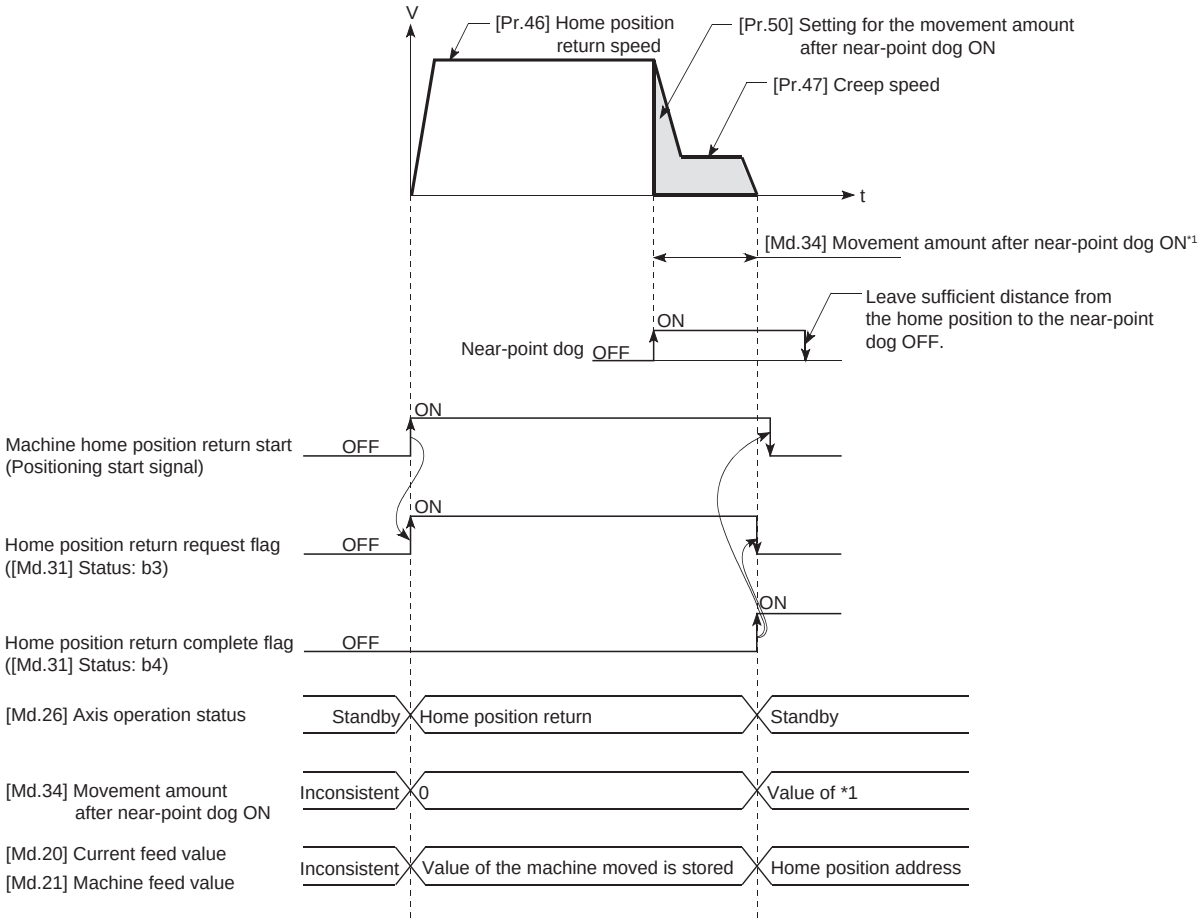
- When the stop signal stops the machine home position return, carry out the machine home position return again. When restart command is turned ON after the stop signal stops the home position return, the error "Home position return restart not possible" (error code: 1946H) will occur.
- After the home position return has been started, the zero point of the encoder must be passed at least once before point A is reached. However, if selecting "1: Not need to pass servo motor Z-phase after power on" with "Function selection C-4 (PC17)", it is possible to carry out the home position return without passing the zero point.

# Count method2

The following shows an operation outline of the home position return method "count method 2".
The "count method 2" method is effective when a "zero signal" cannot be received. (Note that compared to the "count method 1" method, using this method will result in more deviation in the stop position during machine home position return.)



## Operation chart




***1.*** The machine home position return is started.
(The machine begins the acceleration designated in "[Pr.51] Home position return acceleration time selection", in the direction designated in "[Pr.44] Home position return direction". It then moves at the "[Pr.46] Home position return speed" when the acceleration is completed.)

***2.*** The machine begins decelerating when the near-point dog ON is detected.

***3.*** The machine decelerates to the "[Pr.47] Creep speed", and subsequently moves at that speed.

***4.*** The command from the Simple Motion module will stop and the machine home position return will be completed when the machine moves the movement amount set in "[Pr.50] Setting for the movement amount after near-point dog ON" from the near-point dog ON position.

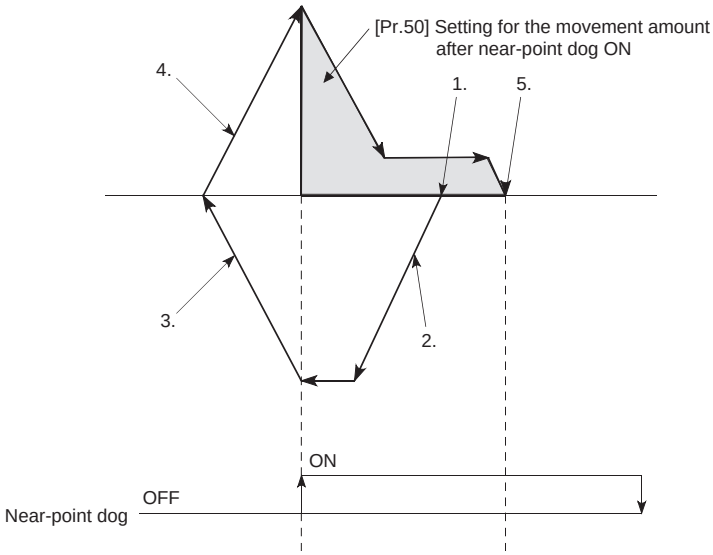
## Restrictions

When this method is used, a deviation will occur in the stop position (home position) compared to other home position return methods because an error occurs in taking in the near-point dog ON. The error varies by the input type of "[Pr.118] DOG signal selection".
The taking error by the input type is shown below.
10 [μs] when setting "0: Simple Motion module"
The operation cycle when setting "1: Servo amplifier"
The operation cycle + scan time when setting "2: Buffer memory"

## Precautions during operation

- The error "Count method movement amount fault" (error code: 1944H) will occur and the operation will not start if the "[Pr.50] Setting for the movement amount after near-point dog ON" is smaller than the deceleration distance from the "[Pr.46] Home position return speed" to "[Pr.47] Creep speed".
- If the speed is changed to a speed faster than "[Pr.46] Home position return speed" by the speed change function (☞ Page 248 Speed change function) during a machine home position return, the distance to decelerate to "[Pr.47] Creep speed" may not be ensured, depending on the setting value of "[Pr.50] Setting for the movement amount after near-point dog ON". In this case, the error "Count method movement amount fault" (error code: 1944H) occurs and the machine home position return is stopped.
- The following shows the operation when a machine home position return is started while the near-point dog is ON.

### ■Operation when a home position return is started at the near-point dog ON position




***1.*** A machine home position return is started.

***2.*** The machine moves at the home position return speed in the opposite direction of a home position return.

***3.*** Deceleration processing is carried out when the near-point dog OFF is detected.

***4.*** After the machine stops, a machine home position return is carried out in the home position return direction.

***5.*** The machine home position return is completed after moving the movement amount set in the "[Pr.50] Setting for the movement amount after near-point dog ON".

- Turn OFF the near-point dog at a sufficient distance from the home position. Although there is no harm in operation if the near-point dog is turned OFF during a machine home position return, it is recommended to leave a sufficient distance from the home position when the near-point dog is turned OFF for the following reason.

If the machine home position return is performed consecutively after the near-point dog is turned OFF at the time of machine home position return completion, operation will be performed at the home position return speed until the hardware stroke limit (upper/lower limit) is reached. If a sufficient distance cannot be kept, consider the use of the home position return retry function.

- When the stop signal stops the machine home position return, carry out the machine home position return again. When restart command is turned ON after the stop signal stops the home position return, the error "Home position return restart not possible" (error code: 1946H) will occur.

# Data set method

The following shows an operation outline of the home position return method "data set method".

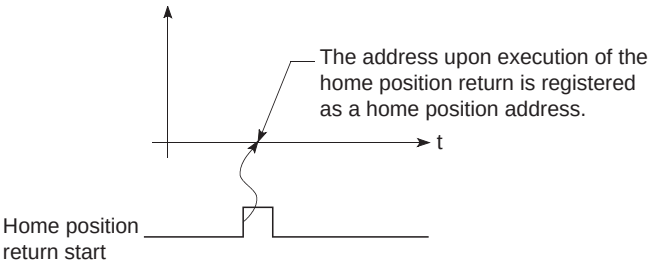
The "Data set method" method is effective when a "Near-point dog" is not used. It can be used with absolute position system.

With the data set method home position return, the position where the machine home position return has been carried out, is registered into the Simple Motion module as the home position, and the current feed value and feed machine value is overwritten to a home position address.

Use the JOG or manual pulse generator operation to move the home position.



## Operation chart




## Precautions during operation

- The zero point must have been passed before the home position return is carried out after the power supply is turned ON. If the home position return is carried out without passing the zero point even once, the error "Home position return zero point not passed" (error code: 197AH) will occur. When the error "Home position return zero point not passed" (error code: 197AH) occurs, perform the JOG or similar operation so that the servomotor makes more than one revolution after an error reset, before carrying out the machine home position return again. However, if selecting "1: Not need to pass servo motor Z-phase after power on" with "Function selection C-4 (PC17)", it is possible to carry out the home position return without passing the zero point.
- The home position return data used for the data set method is the "home position return direction" and "home position address". The home position return data other than that for the home position return direction and home position address is not used for the data set method home position return method, but if a value is set the outside the setting range, an error will occur when the PLC READY signal [Y0] is turned ON so that the READY signal [X0] is not turned OFF. With the home position return data other than that for the home position return direction and home position address, set an arbitrary value (default value can be allowed) within each data setting range so that an error will not occur upon receiving the PLC READY signal [Y0] ON.

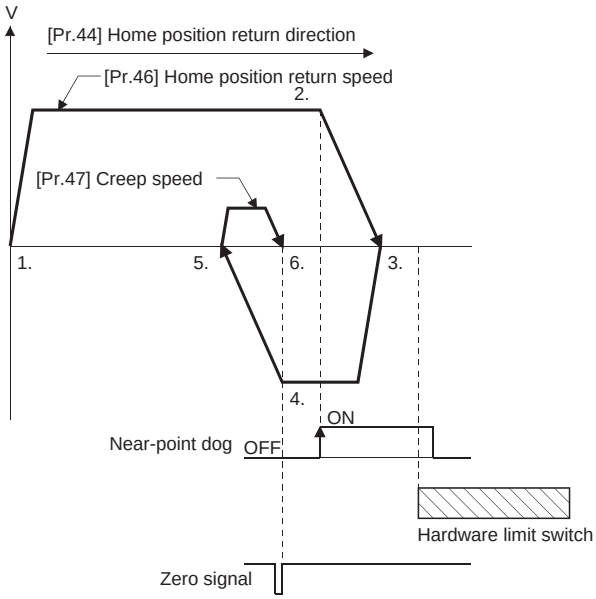
# Scale origin signal detection method

The following shows an operation outline of the home position return method "scale origin signal detection method".

**Point**

Set "0: Need to pass servo motor Z-phase after power on" in "Function selection C-4 (PC17)". If "1: Not need to pass servo motor Z-phase after power on" is set, the error "Z-phase passing parameter invalid" (error code: 1978H) will occur at the start of scale origin signal detection method home position return.

## Operation chart




***1.*** The machine home position return is started.
(The machine begins the acceleration designated in "[Pr.51] Home position return acceleration time selection", in the direction designated in "[Pr.44] Home position return direction". It then moves at the "[Pr.46] Home position return speed" when the acceleration is completed.)

***2.*** The machine begins decelerating when the near-point dog ON is detected.

***3.*** After deceleration stop, the machine moves in the opposite direction against of home position return at the "[Pr.46] Home position return speed".

***4.*** During movement, the machine begins decelerating when the first zero signal is detected.

***5.*** After deceleration stop, the operation moves in direction of home position return at the "[Pr.47] Creep speed", and then stops at the detected nearest zero signal.

***6.*** The home position return complete flag ([Md.31] Status: b4) turns from OFF to ON, and the home position return request flag ([Md.31] Status: b3) turns from ON to OFF.

**Point**

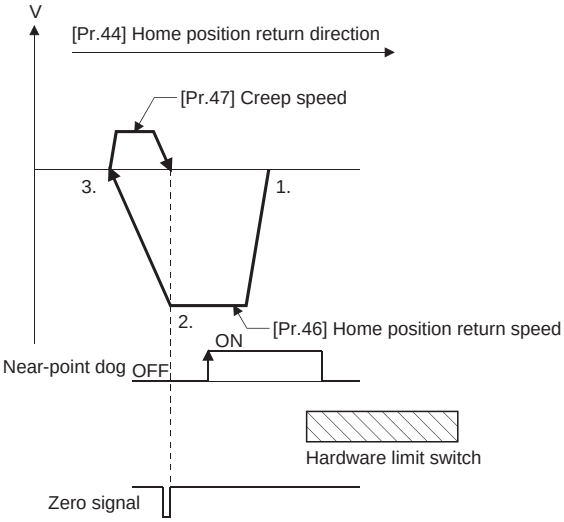
After 3., when the zero signal is in the near-point dog position, deceleration stop (4.) is started at the zero signal without waiting for the near-point dog OFF.

## Precautions during operation

- The error "Start at home position" (error code: 1940H) will occur if another machine home position return is attempted immediately after a machine home position return completion when the home position is in the near-point dog ON position.
- The following shows the operation when a machine home position return is started from the near-point dog ON position.



### ■Operation when a machine home position return is started from the near-point dog ON position




***1.*** The machine moves in the opposite direction against of home position return at the home position return speed.

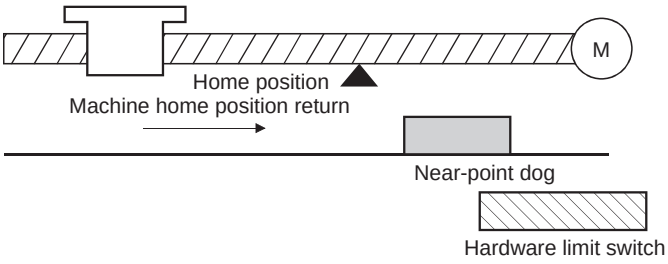
***2.*** The machine begins decelerating when the first zero signal is detected.

***3.*** After deceleration stop, the operation moves in direction of home position return at the creep speed, and then stops at the zero signal to complete the machine home position return.

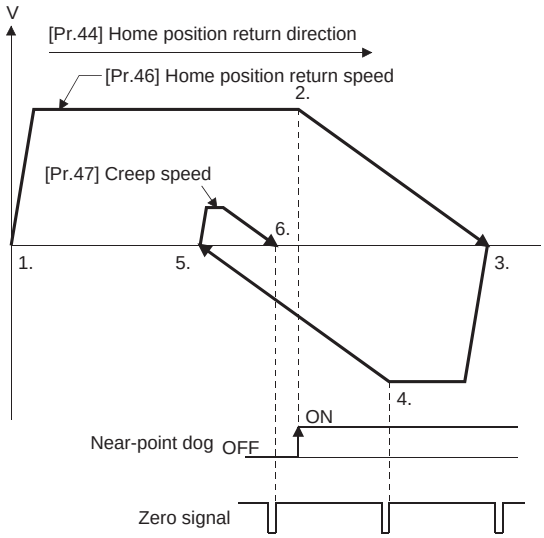
**Point**

After 1., when the zero signal is in the near-point dog ON position, deceleration stop (2.) is started at the zero signal without waiting for the near-point dog OFF.

- When the stop signal stops the machine home position return, carry out the machine home position return again. When restart command is turned ON after the stop signal stops the home position return, the error "Home position return restart not possible" (error code: 1946H) will occur.
- The home position return retry will not be performed regardless of setting set in "[Pr.48] Home position return retry" in the scale origin signal detection method. When a hardware limit switch is detected during machine home position return, the error "Hardware stroke limit (+)" (error code: 1904H, 1905H) or "Hardware stroke limit (-)" (error code: 1906H, 1907H) will occur.
- Position the near-point dog forward to overlaps with the hardware limit switch in direction of home position return. When the near-point dog is in the opposite direction against of home position return from the machine home position return start position, the error "Hardware stroke limit (+)" (error code: 1904H, 1905H) or "Hardware stroke limit (-)" (error code: 1906H, 1907H) will occur.



- When the zero signal is detected again during deceleration (4.) in the following figure) with detection of zero signal, the operation stops at the zero signal detected lastly to complete the home position return.




- Do not use the scale origin signal detection method home position return for the machine with the backlash.
- When using the direct drive motor, make it passed the Z phase once before reaching 3. in the previous operation chart. (☞ Page 42 Scale origin signal detection method)

# 2.3 Fast Home Position Return

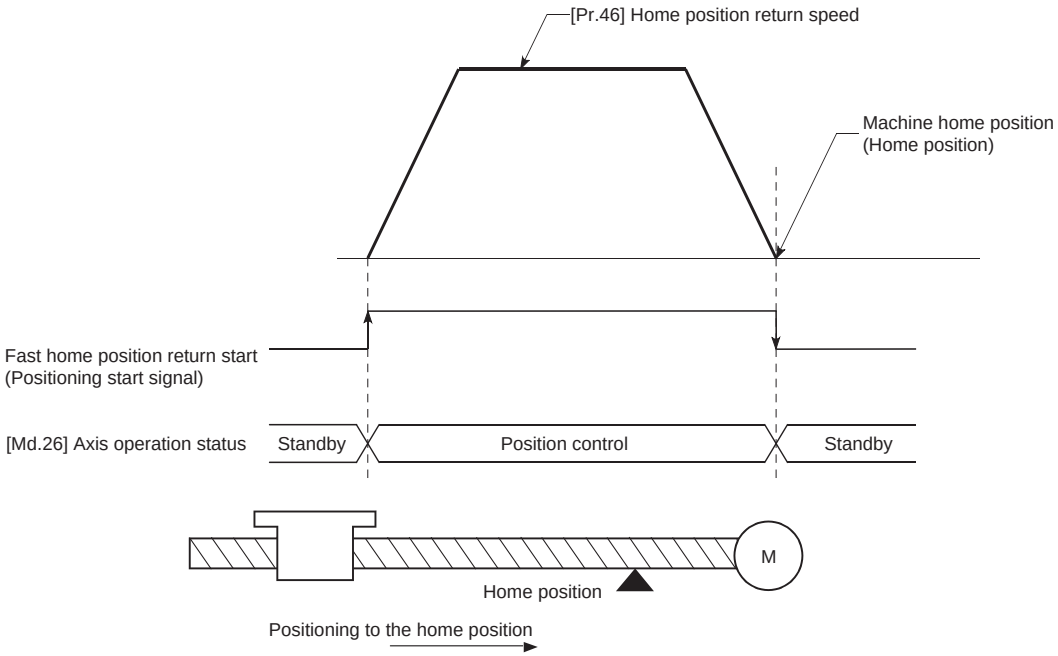
## Outline of the fast home position return operation



### Fast home position return operation

After establishing home position by a machine home position return, positioning control to the home position is executed without using a near-point dog or a zero signal.

The following shows the operation during a basic fast home position return start.

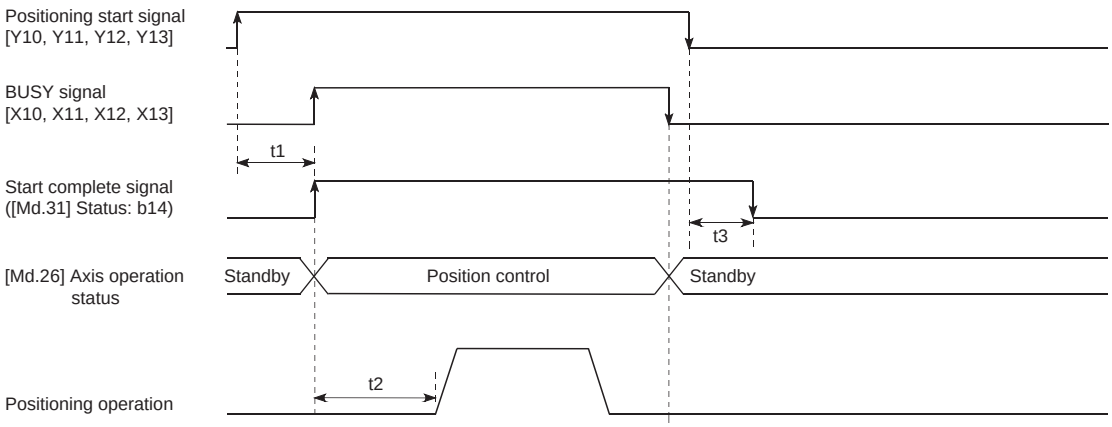



1. The fast home position return is started.
2. Positioning control to the home position established by a machine home position return begins at speed set in the home position return parameters ([Pr.43] to [Pr.57]).
3. The fast home position return is completed.

### Operation timing and processing time

The following shows details about the operation timing and time during fast home position return.

[RD77MS4 operation example]



- Normal timing time (Unit: [ms])

| Operation cycle | t1[*1] | t2 | t3 |
|---|---|---|---|
| 0.444 | 0.186 to 1.228 | 1.186 to 1.662 | 0.000 to 0.444 |
| 0.888 | 0.186 to 1.228 | 2.234 to 2.330 | 0.000 to 0.888 |
| 1.777 | 0.186 to 1.228 | 3.932 to 4.550 | 0.000 to 1.777 |
| 3.555 | 0.186 to 1.228 | 5.520 to 8.098 | 0.000 to 3.555 |

*1 The t1 timing time could be delayed by the operation state of other axes.

## Operating restrictions

- The fast home position return can only be executed after the home position is established by executing the machine home position return. If not, the error "Home position return request ON" (error code: 1945H) will occur. (Home position return request flag ([Md.31] Status: b3) must be turned OFF).
- If the fraction pulse is cleared to zero using current value changing or fixed-feed control, execute the fast home position return and an error will occur by a cleared amount.
- When unlimited length feed is executed by speed control and the machine feed value overflows or underflows once, the fast home position return cannot be executed normally.
- The home position return complete flag ([Md.31] Status: b4) is not turned ON.
- The axis operation status during fast home position return is "in position control".

# 2.4 Selection of the Home Position Return Setting Condition



## Outline of the home position return setting condition

To execute the home position return when selecting "0: Need to pass servo motor Z-phase after power on" with "Function selection C-4 (PC17)", it is necessary that the servomotor has been rotated more than one revolution and passed the Z phase (Motor reference position signal) and that the zero point pass signal ([Md.119] Servo status2: b0) has turned ON.
When selecting "1: Not need to pass servo motor Z-phase after power on" with "Function selection C-4 (PC17)", it is possible to turn the zero point pass signal ([Md.119] Servo status2: b0) ON without passing the zero point.
n: Axis No. - 1

| Monitor item | Buffer memory address |
|---|---|
| [Md.119] Servo status2: b0 | 2476+100n |

### Data setting

To select the "home position return setting condition", set the "servo amplifier" shown in the following table.
Servo parameters are set for each axis.
The "home position return setting condition" is stored into the following buffer memory addresses.
n: Axis No. - 1

| Setting item | Setting value | Setting details | Buffer memory address |
|---|---|---|---|
| Function selection C-4 (PC17) | 0 | 0: Need to pass servo motor Z-phase after power on<br>1: Not need to pass servo motor Z-phase after power on | 28480+100n |

*1 Refer to the following for information on the storage details.
☞ Page 444 Servo parameters

### Precautions during operation

- Set "Function selection C-4 (PC17)" (transferred the parameter to the servo amplifier from the Simple Motion module), and then turn off the power supply of the servo amplifier once and switch it on again to make that parameter setting valid.

# 3 MAJOR POSITIONING CONTROL

The details and usage of the major positioning controls (control functions using the "positioning data") are explained in this chapter.
The major positioning controls include such controls as "positioning control" in which positioning is carried out to a designated position using the address information, "speed control" in which a rotating object is controlled at a constant speed, "speed-position switching control" in which the operation is shifted from "speed control" to "position control" and "position-speed switching control" in which the operation is shifted from "position control" to "speed control".
Execute the required settings to match each control.

## 3.1 Outline of Major Positioning Controls

"Major positioning controls" are carried out using the "positioning data" stored in the Simple Motion module.
The basic controls such as position control and speed control are executed by setting the required items in this "positioning data", and then starting that positioning data.
The control method for the "major positioning controls" is set in setting item "[Da.2] Control method" of the positioning data.
Control defined as a "major positioning control" carries out the following types of control according to the "[Da.2] Control method" setting. However, the position loop is included for commanding to servo amplifier in the speed control set in "[Da.2] Control method". Use the "speed-torque control" to execute the speed control not including position loop. (☞ Page 193 Speed-torque Control)

| Major positioning control | | | [Da.2] Control method | Details |
|---|---|---|---|---|
| Position control | Linear control | 1-axis linear control | ABS Linear 1<br>INC Linear 1 | Positioning of the designated 1 axis is carried out from the start address (current stop position) to the designated position. |
| | | 2-axis linear interpolation control*1 | ABS Linear 2<br>INC Linear 2 | Using the designated 2 axes, linear interpolation control is carried out from the start address (current stop position) to the designated position. |
| | | 3-axis linear interpolation control*1 | ABS Linear 3<br>INC Linear 3 | Using the designated 3 axes, linear interpolation control is carried out from the start address (current stop position) to the designated position. |
| | | 4-axis linear interpolation control*1 | ABS Linear 4<br>INC Linear 4 | Using the designated 4 axes, linear interpolation control is carried out from the start address (current stop position) to the designated position. |
| | Fixed-feed control | 1-axis fixed-feed control | Fixed-feed 1 | Positioning of the designated 1 axis is carried out for a designated movement amount from the start address (current stop position).<br>(The "[Md.20] Current feed value" is set to "0" at the start.) |
| | | 2-axis fixed-feed control*1 | Fixed-feed 2 | Using the designated 2 axes, linear interpolation control is carried out for a designated movement amount from the start address (current stop position).<br>(The "[Md.20] Current feed value" is set to "0" at the start.) |
| | | 3-axis fixed-feed control*1 | Fixed-feed 3 | Using the designated 3 axes, linear interpolation control is carried out for a designated movement amount from the start address (current stop position).<br>(The "[Md.20] Current feed value" is set to "0" at the start.) |
| | | 4-axis fixed-feed control*1 | Fixed-feed 4 | Using the designated 4 axes, linear interpolation control is carried out for a designated movement amount from the start address (current stop position).<br>(The "[Md.20] Current feed value" is set to "0" at the start.) |
| | 2-axis circular interpolation control*1 | Sub point designation | ABS Circular sub<br>INC Circular sub | Using the designated 2 axes, positioning is carried out in an arc path to a position designated from the start point address (current stop position). |
| | | Center point designation | ABS Circular right<br>ABS Circular left<br>INC Circular right<br>INC Circular left | |
| | 3-axis helical interpolation control*1 | Sub point designation | ABS helical sub<br>INC helical sub | Using two axes of the three axes, the circular interpolation control is carried out. The remaining axis is used for the positioning of the helical, tangent line, or normal line control to follow the circular interpolation control. |
| | | Center point designation | ABS helical right<br>ABS helical left<br>INC helical right<br>INC helical left | |

| Major positioning control | | [Da.2] Control method | Details |
|---|---|---|---|
| Speed control | 1-axis speed control | Forward run speed 1<br>Reverse run speed 1 | The speed control of the designated 1 axis is carried out. |
| | 2-axis speed control*1 | Forward run speed 2<br>Reverse run speed 2 | The speed control of the designated 2 axes is carried out. |
| | 3-axis speed control*1 | Forward run speed 3<br>Reverse run speed 3 | The speed control of the designated 3 axes is carried out. |
| | 4-axis speed control*1 | Forward run speed 4<br>Reverse run speed 4 | The speed control of the designated 4 axes is carried out. |
| Speed-position switching control | | Forward run speed/position<br>Reverse run speed/position | The control is continued as position control (positioning for the designated address or movement amount) by turning ON the "speed-position switching signal" after first carrying out speed control. |
| Position-speed switching control | | Forward run position/speed<br>Reverse run position/speed | The control is continued as speed control by turning ON the "position-speed switching signal" after first carrying out position control. |
| Other control | NOP instruction | NOP | A nonexecutable control method. When this instruction is set, the operation is transferred to the next data operation, and the instruction is not executed. |
| | Current value changing | Current value changing | "[Md.20] Current feed value" is changed to an address set in the positioning data.<br>This can be carried out by either of the following 2 methods.<br>("[Md.21] Machine feed value" cannot be changed.)<br>• Current value changing using the control method<br>• Current value changing using the current value changing start No. (No. 9003). |
| | JUMP instruction | JUMP instruction | An unconditional or conditional JUMP is carried out to a designated positioning data No. |
| | LOOP | LOOP | A repeat control is carried out by repeat LOOP to LEND. |
| | LEND | LEND | Control is returned to the top of the repeat control by repeat LOOP to LEND. After the repeat operation is completed specified times, the next positioning data is run. |

*1 Control is carried out so that linear and arc paths are drawn using a motor set in two or more axes directions. This kind of control is called "interpolation control". (☞ Page 64 Interpolation control)

*2 In the RD77MS2, when 3- or 4-axis interpolation is carried out, or axis 3 or axis 4 is designated to the axis to be interpolated for 2-axis interpolation, the error "Illegal interpolation description command" (error code: 1A22H) will occur and the positioning control does not start.

# Data required for major positioning control

The following table shows an outline of the "positioning data" configuration and setting details required to carry out the "major positioning controls".

| Setting item | | | Setting details |
|---|---|---|---|
| Positioning data No. 1 | [Da.1] | Operation pattern | Set the method by which the continuous positioning data (Ex: positioning data No.1, No.2, No.3) will be controlled. (☞ Page 51 Operation patterns of major positioning controls) |
| | [Da.2] | Control method | Set the control method defined as a "major positioning control". (☞ Page 48 Outline of Major Positioning Controls) |
| | [Da.3] | Acceleration time No. | Select and set the acceleration time at control start. (Select one of the four values set in [Pr.9], [Pr.25], [Pr.26], and [Pr.27] for the acceleration time.) |
| | [Da.4] | Deceleration time No. | Select and set the deceleration time at control stop. (Select one of the four values set in [Pr.10], [Pr.28], [Pr.29], and [Pr.30] for the deceleration time.) |
| | [Da.6] | Positioning address/movement amount | Set the target value during position control. (☞ Page 58 Designating the positioning address) |
| | [Da.7] | Arc address | Set the sub point or center point address during circular interpolation control or 3-axis helical interpolation control. |
| | [Da.8] | Command speed | Set the speed during the control execution. |
| | [Da.9] | Dwell time/JUMP destination positioning data No. | The time between the command pulse output is completed to the positioning completed signal is turned ON. Set it for absorbing the delay of the mechanical system to the instruction, such as the delay of the servo system (deviation). |
| | [Da.10] | M code/Condition data No./ Number of LOOP to LEND repetitions/Number of pitches | Set this item when carrying out sub work (clamp and drill stops, tool replacement, etc.) corresponding to the code No. related to the positioning data execution. |
| | [Da.20] | Axis to be interpolated No.1 | Set an axis to be interpolated during the 2- to 4-axis interpolation operation. (☞ Page 64 Interpolation control) |
| | [Da.21] | Axis to be interpolated No.2 | |
| | [Da.22] | Axis to be interpolated No.3 | |
| | [Da.27] | M code ON signal output timing | Set the M code ON signal output timing to each positioning data. |
| | [Da.28] | ABS direction in degrees | Set the ABS direction in degrees to each positioning data. |
| | [Da.29] | Interpolation speed designation method | Set the interpolation speed designation method to each positioning data. |

*1 The settings and setting requirement for the setting details of [Da.1] to [Da.10], [Da.20] to [Da.22] and [Da.27] to [Da.29] differ according to the "[Da.2] Control method". (☞ Page 68 Setting the Positioning Data)

## Major positioning control sub functions

Refer to the following for details on "sub functions" that can be combined with the major positioning control.

MELSEC iQ-R Simple Motion Module User's Manual (Startup)

Also refer to the following for details on each sub function.

☞ Page 215 CONTROL SUB FUNCTIONS

**Point**

600 positioning data (positioning data No. 1 to 600) items can be set per axis.

# Operation patterns of major positioning controls

In "major positioning control" (high-level positioning control), "[Da.1] Operation pattern" can be set to designate whether to continue executing positioning data after the started positioning data. The "operation pattern" includes the following 3 types.

| Positioning control | Operation pattern |
|---|---|
| Positioning complete | Independent positioning control (operation pattern: 00) |
| Positioning continue | Continuous positioning control (operation pattern: 01) |
| | Continuous path control (operation pattern: 11) |

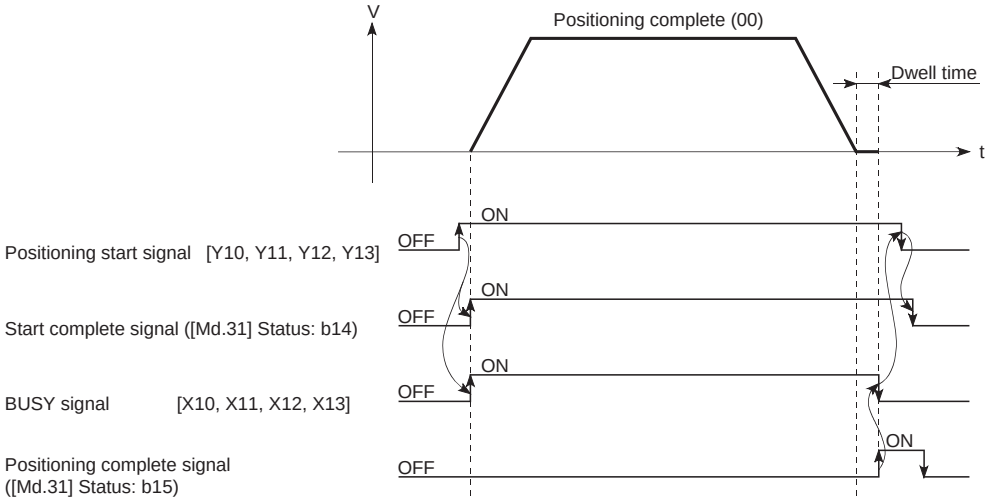


## Independent positioning control (Positioning complete)

This control is set when executing only one designated data item of positioning. If a dwell time is designated, the positioning completes after the designated time elapses.

This data (operation pattern [00] data) becomes the end of block data when carrying out block positioning. (The positioning stops after this data is executed.)

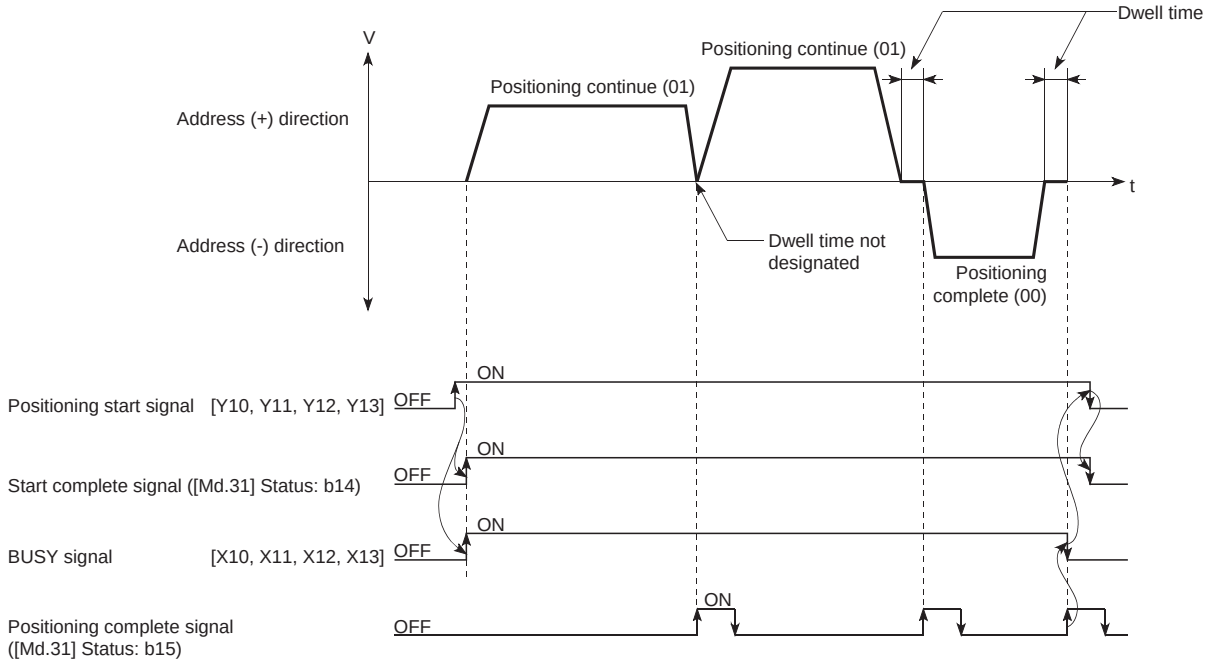
[RD77MS4 operation example]



## Continuous positioning control

- The machine always automatically decelerates each time the positioning is completed. Acceleration is then carried out after the Simple Motion module command speed reaches 0 to carry out the next positioning data operation. If a dwell time is designated, the acceleration is carried out after the designated time elapses.
- In operation by continuous positioning control (operation pattern "01"), the next positioning No. is automatically executed. Always set operation pattern "00" in the last positioning data to complete the positioning. If the operation pattern is set to positioning continue ("01" or "11"), the operation will continue until operation pattern "00" is found. If the operation pattern "00" cannot be found, the operation may be carried out until the positioning data No. 600. If the operation pattern of the positioning data No. 600 is not completed, the operation will be started again from the positioning data No. 1.

[RD77MS4 operation example]

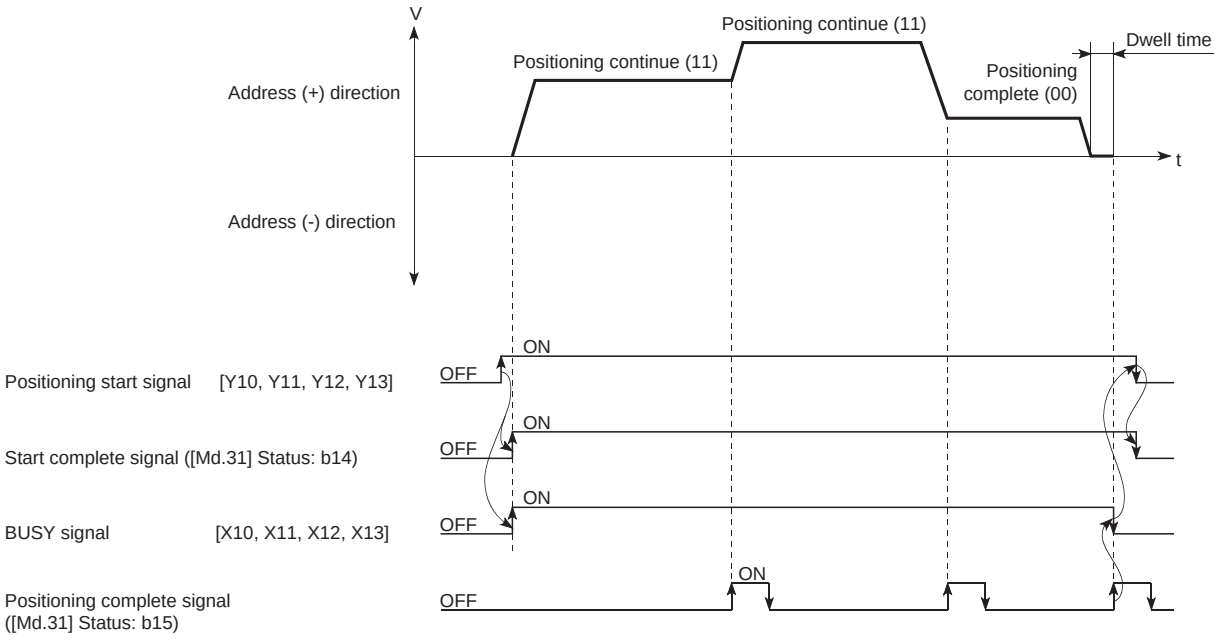


## Continuous path control

### ■Continuous path control

- The speed is changed without deceleration stop between the command speed of the "positioning data No. currently being executed" and the speed of the "positioning data No. to carry out the next operation". The speed is not changed if the current speed and the next speed are equal.
- The speed used in the previous positioning operation is continued when the command speed is set to "-1".
- Dwell time is ignored, even if it is set.
- The next positioning No. is executed automatically in operations by continuous path control (operation pattern "11"). Always complete the positioning by setting operation pattern "00" in the last positioning data. If the operation pattern is set to positioning continue ("01" or "11"), the operation will continue until operation pattern "00" is found. If the operation pattern "00" cannot be found, the operation may be carried out until the positioning data No. 600. If the operation pattern of the positioning data No. 600 is not complete, the operation will be started again from the positioning data No. 1.
- The speed switching includes the "front-loading speed switching mode" in which the speed is changed at the end of the current positioning side, and the "standard speed switching mode" in which the speed is at the start of the next positioning side. (☞ Page 421 [Pr.19] Speed switching mode)
- In the continuous path control, the positioning may be completed before the set address/movement amount and the current data may be switched to the "positioning data that will be run next". This is because a preference is given to the positioning at a command speed. In actuality, the positioning is completed before the set address/movement amount by an amount of remaining distance at speeds less than the command speed. The remaining distance (Δ1) at speeds less than the command speed is $0 \leq \Delta 1 \leq$ (distance moved in operation cycle at a speed at the time of completion of the positioning). The remaining distance (Δ1) is output at the next positioning data No.

### ■RD77MS4 operation example



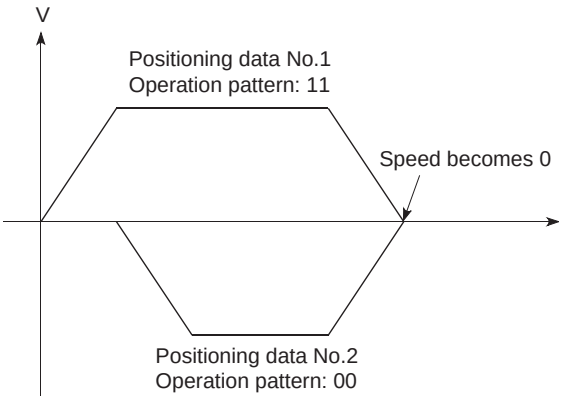

**Point**

In the continuous path control, a speed variation will not occur using the near-pass function when the positioning data No. is switched.
(☞ Page 231 Near pass function)

## ■Deceleration stop conditions during continuous path control

Deceleration stops are not carried out in continuous path control, but the machine will carry out a deceleration stop to speed "0" in the following 3 cases.

- When the operation pattern of the positioning data currently being executed is "continuous path control: 11", and the movement direction of the positioning data currently being executed differs from that of the next positioning data. (Only for 1-axis positioning control (Refer to the next point.))

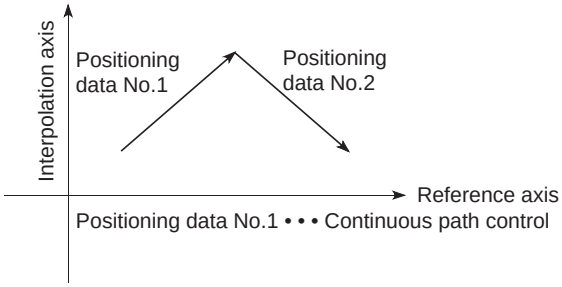



- During operation by step operation. (☞ Page 273 Step function)
- When there is an error in the positioning data to carry out the next operation.

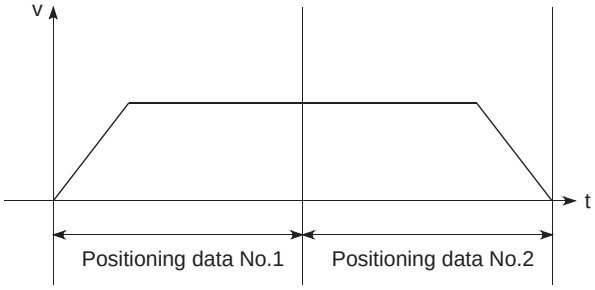
**Point**

- The movement direction is not checked during interpolation operations. Thus, automatic deceleration to a stop will not be carried out even if the movement direction is changed (See the figures below). Because of this, the interpolation axis may suddenly reverse direction. To avoid this sudden direction reversal in the interpolation axis, set the pass point to continuous positioning control "01" instead of setting it to continuous path control "11".

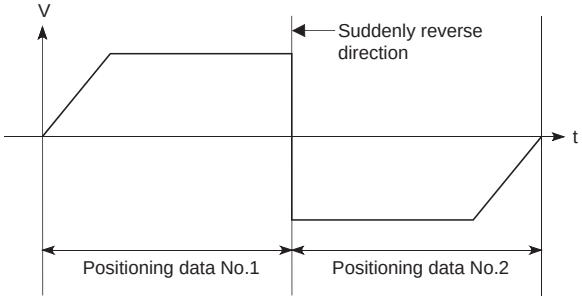
[Positioning by interpolation]




[Reference axis operation]




[Interpolation axis operation]

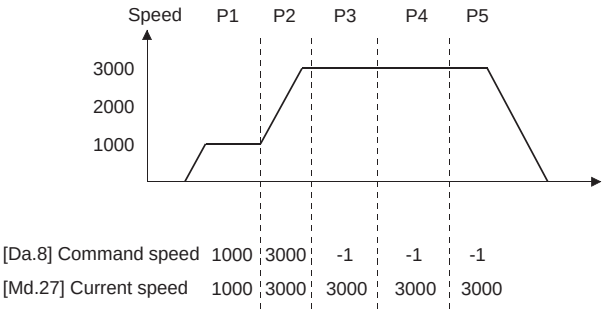


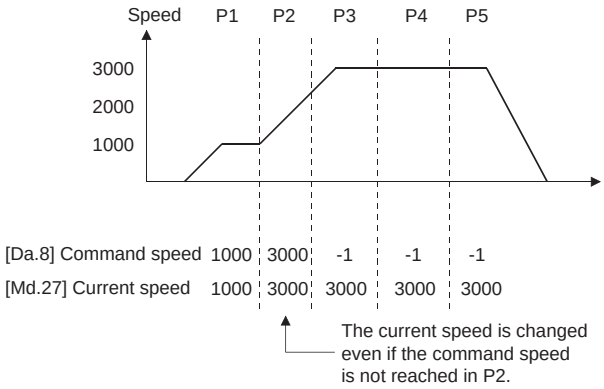

- When a "0" is set in the "[Da.6] Positioning address/movement amount" of the continuous path control positioning data, the command speed is reduced to 0 in an operation cycle. When a "0" is set in the "[Da.6] Positioning address/movement amount" to increase the number of speed change points in the future, change the "[Da.2] Control method" to the "NOP" to make the control nonexecutable. (☞ Page 138 NOP instruction)
- In the continuous path control positioning data, assure a movement distance so that the execution time with that data is 100 ms or longer, or lower the command speed.

## ■Speed handling

- Continuous path control command speeds are set with each positioning data. The Simple Motion module carries out the positioning at the speed designated with each positioning data.
- The command speed can be set to "-1" in continuous path control. The control will be carried out at the speed used in the previous positioning data No. if the command speed is set to "-1". The "current speed" will be displayed in the command speed when the positioning data is set with an engineering tool. The current speed is the speed of the positioning control being executed currently.
- The speed does not need to be set in each positioning data when carrying out uniform speed control if "-1" is set beforehand in the command speed.
- If the speed is changed or the override function is executed, in the previous positioning data when "-1" is set in the command speed, the operation can be continued at the new speed.
- The error "No command speed" (error code: 1A12H to 1A14H) occurs and positioning cannot be started if "-1" is set in the command speed of the first positioning data at start.

[Relation between the command speed and current speed]



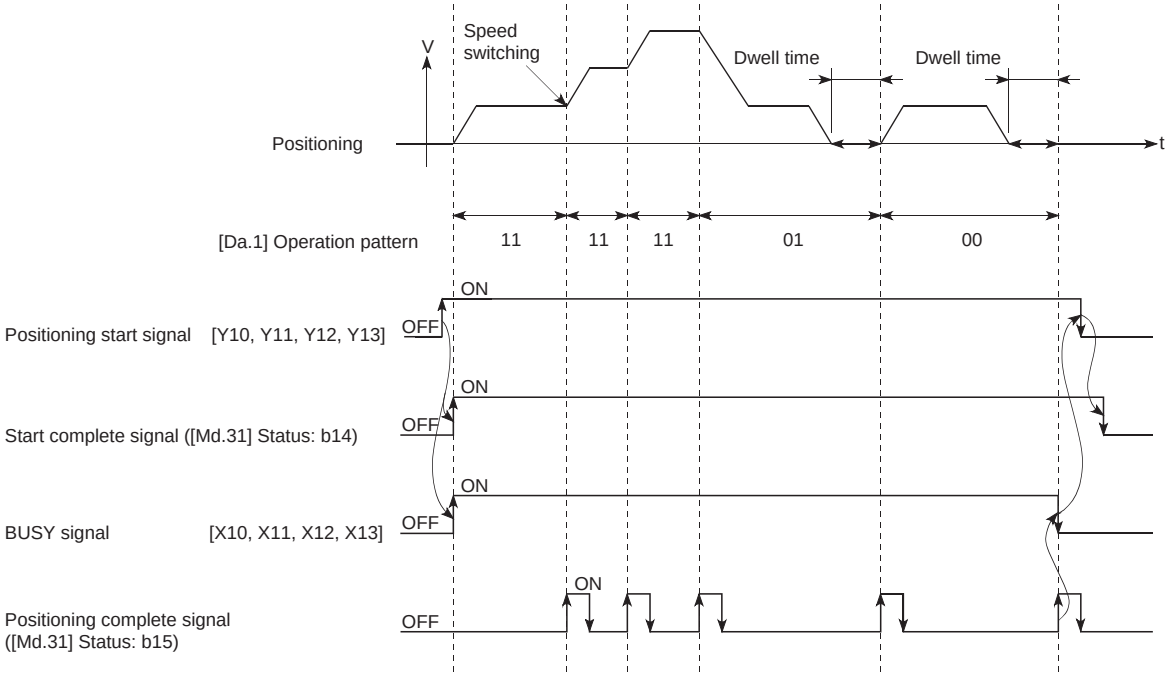

**Point**

- In the continuous path control, a speed variation will not occur using the near-pass function when the positioning data is switched. (☞ Page 231 Near pass function)
- The Simple Motion module holds the command speed set with the positioning data, and the latest value of the speed set with the speed change request as the "[Md.27] Current speed". It controls the operation at the "current speed" when "-1" is set in the command speed. (Depending on the relation between the movement amount and the speed, the feedrate may not reach the command speed value, but even then the current speed will be updated.)
- When the address for speed change is identified beforehand, generate and execute the positioning data for speed change by the continuous path control to carry out the speed change without requesting the speed change with a program.

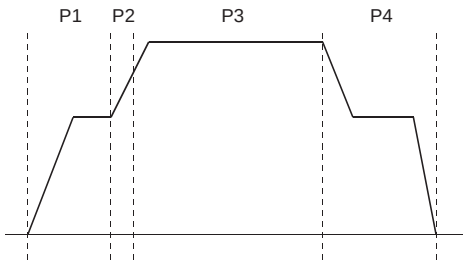
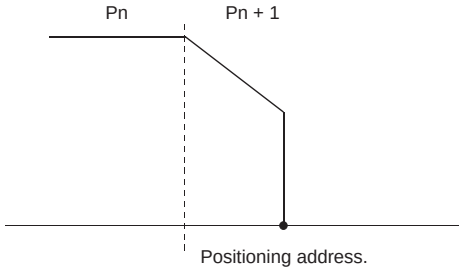
## ■Speed switching (Standard speed switching mode: Switch the speed when executing the next positioning data.) (☞ Page 421 [Pr.19] Speed switching mode)

- If the respective command speeds differ in the "positioning data currently being executed" and the "positioning data to carry out the next operation", the machine will accelerate or decelerate after reaching the positioning point set in the "positioning data currently being executed" and the speed will change over to the speed set in the "positioning data to carry out the next operation".
- The parameters used in acceleration/deceleration to the command speed set in the "positioning data to carry out the next operation" are those of the positioning data to carry out acceleration/deceleration. Speed switching will not be carried out if the command speeds are the same.

## ■RD77MS4 operation example




- If the movement amount is small in regard to the target speed, the current speed may not reach the target speed even if acceleration/deceleration is carried out. In this case, the machine is accelerated/decelerated so that it nears the target speed. If the movement amount will be exceeded when automatic deceleration is required (Ex. Operation patterns "00", "01", etc.), the machine will immediately stop at the designated positioning address, and the warning "Insufficient movement amount" (warning code: 0998H) will occur.

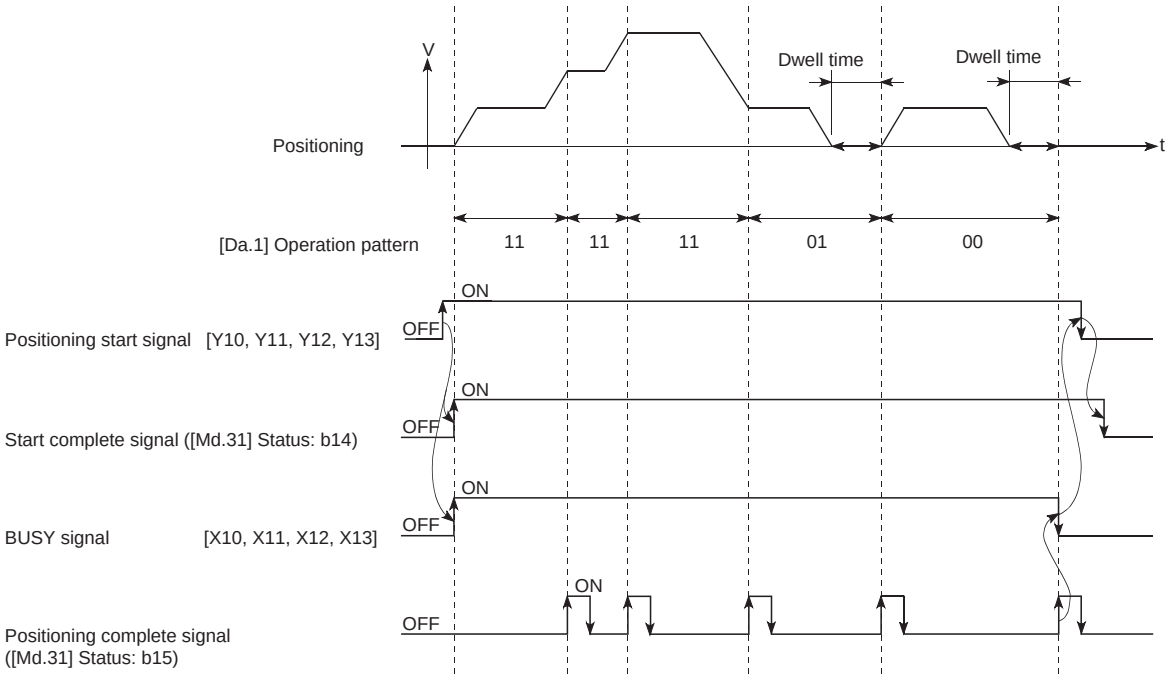
| [When the speed cannot change over in P2] | [When the movement amount is small during automatic deceleration] |
|---|---|
| For the following relation of the speed P1 = P4, P2 = P3, P1 < P2<br>  | The movement amount required to carry out the automatic deceleration cannot be secured, so the machine immediately stops in a speed ≠ 0 status.<br>  |

## ■Speed switching (Front-loading speed switching mode: The speed switches at the end of the positioning data currently being executed.) (☞ Page 421 [Pr.19] Speed switching mode)

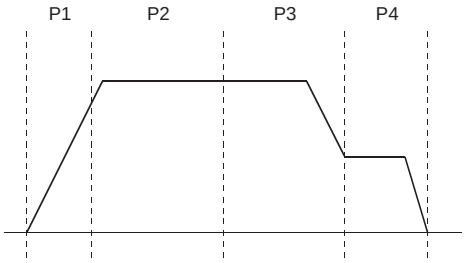
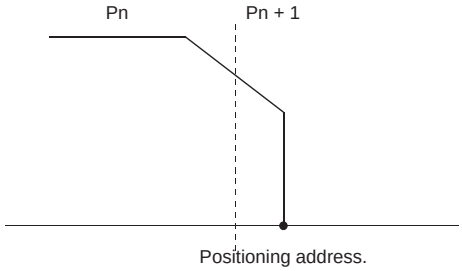
- If the respective command speeds differ in the "positioning data currently being executed" and the "positioning data to carry out the next operation", the speed will change over to the speed set in the "positioning data to carry out the next operation" at the end of the "positioning data currently being executed".
- The parameters used in acceleration/deceleration to the command speed set in the "positioning data to carry out the next operation" are those of the positioning data to carry out acceleration/deceleration. Speed switching will not be carried out if the command speeds are the same.



## ■RD77MS4 operation example




- If the movement amount is small in regard to the target speed, the current speed may not reach the target speed even if acceleration/deceleration is carried out. In this case, the machine is accelerated/decelerated so that it nears the target speed. If the movement amount will be exceeded when automatic deceleration is required (Ex. Operation patterns "00", "01", etc.), the machine will immediately stop at the designated positioning address, and the warning "Insufficient movement amount" (warning code: 0998H) will occur.

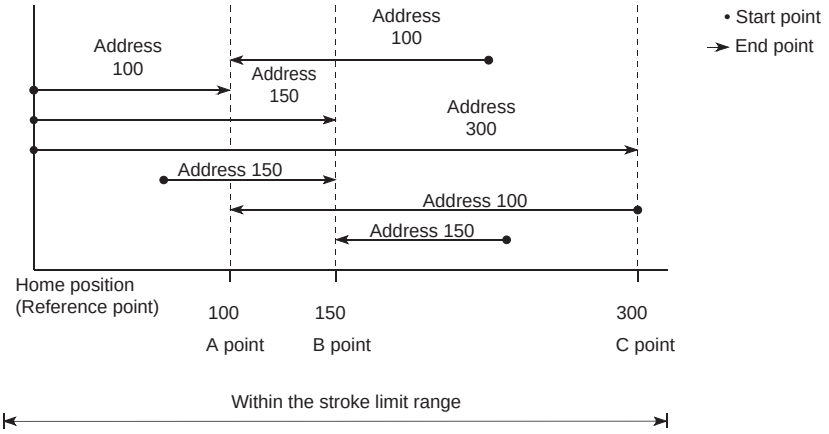
| [When the speed cannot change over to the P2 speed in P1] | [When the movement amount is small during automatic deceleration] |
|---|---|
| For the following relation of the speed P1 = P4, P2 = P3, P1 < P2<br>  | The movement amount required to carry out the automatic deceleration cannot be secured, so the machine immediately stops in a speed ≠ 0 status.<br>  |

# Designating the positioning address

The following shows the two methods for commanding the position in control using positioning data.

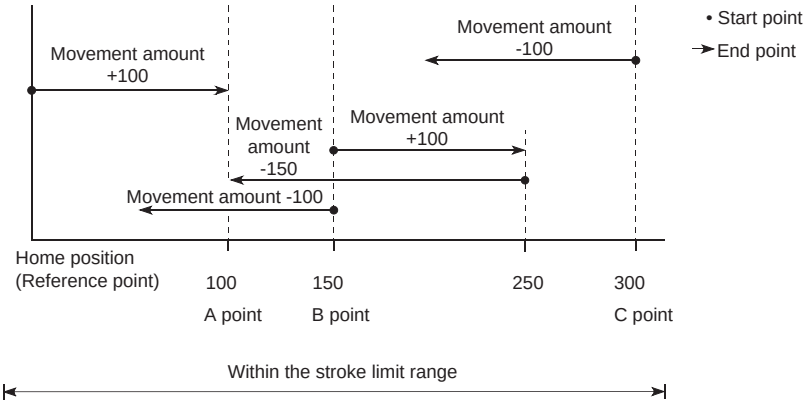
## Absolute system

Positioning is carried out to a designated position (absolute address) having the home position as a reference. This address is regarded as the positioning address. (The start point can be anywhere.)




## Incremental system

The position where the machine is currently stopped is regarded as the start point, and positioning is carried out for a designated movement amount in a designated movement direction.



# Confirming the current value

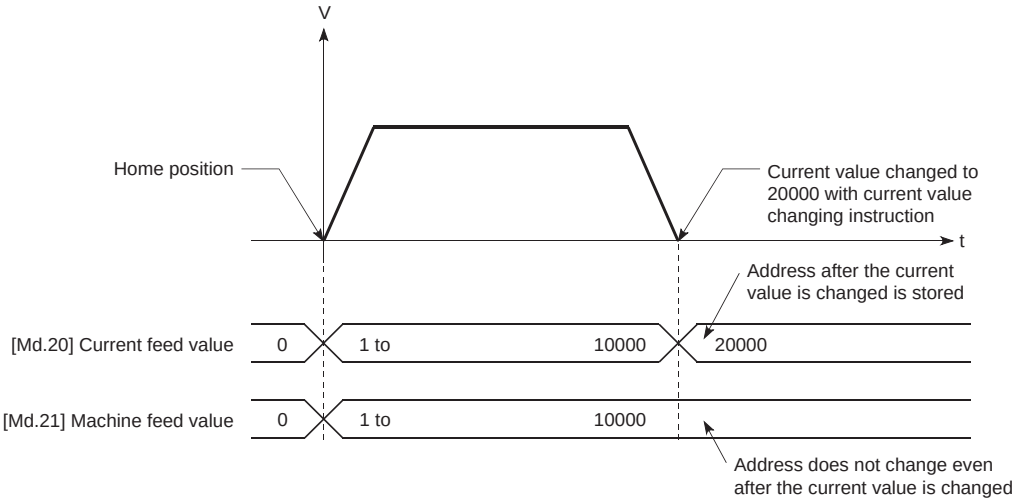
## Values showing the current value

The following two types of addresses are used as values to show the position in the Simple Motion module.

These addresses ("current feed value" and "machine feed value") are stored in the monitor data area, and used in monitoring the current value display, etc.

| Current feed value | Machine feed value |
|---|---|
| • This is the value stored in "[Md.20] Current feed value".<br>• This value has an address established with a "machine home position return" as a reference, but the address can be changed by changing the current value to a new value. | • This is the value stored in "[Md.21] Machine feed value".<br>• This value always has an address established with a "machine home position return" as a reference. The address cannot be changed, even if the current value is changed to a new value. |

The "current feed value" and "machine feed value" are used in monitoring the current value display, etc.




**Restriction**

Operation cycle error will occur in the current value refresh cycle when the stored "current feed value" and "machine feed value" are used in the control.

## Monitoring the current value

The "current feed value" and "machine feed value" are stored in the following buffer memory addresses, and can be read using a "DFROM(P) instruction" or "DMOV(P) instruction" from the CPU module.

n: Axis No. - 1

| Monitor item | | Buffer memory addresses |
|---|---|---|
| [Md.20] | Current feed value | 2400+100n<br>2401+100n |
| [Md.21] | Machine feed value | 2402+100n<br>2403+100n |

The following shows the program example that stores the current feed value of the axis 1 in the specified device when X40 is turned ON.

| Classification | Label name | Description |
|---|---|---|
| Module label | RD77_1.stnAxMntr_D[0].dCommandPosition_D dCurrentFeedValue | Axis 1 Current feed value |
| Global label, local label | Defines the global label or the local label as follows. The settings of Assign (Device/Label) are not required for the label that the assignment device is not set because the unused internal relay and data device are automatically assigned. | |

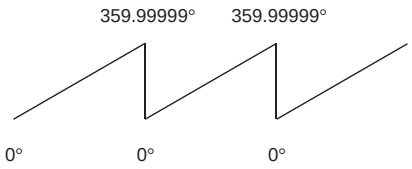
| | Label Name | Data Type | | Class |
|---|---|---|---|---|
| 1 | dCurrentFeedValue | Double Word [Signed] | ... | VAR |
| 2 | bCurrentFeedValueReadReq | Bit | ... | VAR |
| 3 | | | ... | |

# Control unit "degree" handling

When the control unit is set to "degree", the following items differ from when other control units are set.

## Current feed value and machine feed value addresses

The address of "[Md.20] Current feed value" becomes a ring address from 0 to 359.99999°. The address of "[Md.21] Machine feed value" will become a cumulative value. (They will not have a ring structure for values between 0 and 359.99999°.) However, "[Md.21] Machine feed value" is restored within the range of 0 to 359.99999° at the communication start with servo amplifier after the power supply ON or CPU module reset.

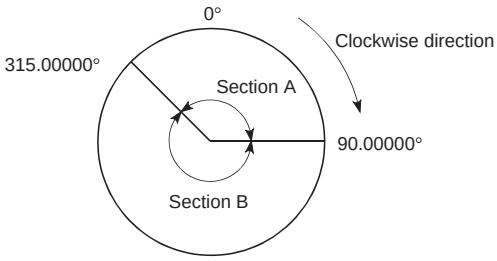



## Software stroke limit valid/invalid setting

With the control unit set to "degree", the software stroke limit upper and lower limit values are 0° to 359.99999°.

### ■Setting to validate software stroke limit

To validate the software stroke limit, set the software stroke limit lower limit value and the upper limit value in a clockwise direction.




- To set the movement range A, set as follows.

| | |
|---|---|
| Software stroke limit lower limit value | 315.00000° |
| Software stroke limit upper limit value | 90.00000° |

- To set the movement range B, set as follows.

| | |
|---|---|
| Software stroke limit lower limit value | 90.00000° |
| Software stroke limit upper limit value | 315.00000° |

### ■Setting to invalidate software stroke limit

To invalidate the software stroke limit, set the software stroke limit lower limit value equal to the software stroke limit upper limit value.

The control can be carried out irrespective of the setting of the software stroke limit.

**Point**

- When the upper/lower limit value of the axis which set the software stroke limit as valid are changed, perform the machine home position return after that.
- When the software stroke limit is set as valid in the incremental data system, perform the machine home position return after power supply on.

## Positioning control method when the control unit is set to "degree"

### ■Absolute system (When the software stroke limit is invalid)

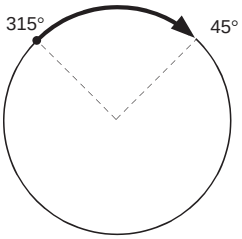
Positioning is carried out in the nearest direction to the designated address, using the current value as a reference. (This is called "shortcut control".)

**Ex.**

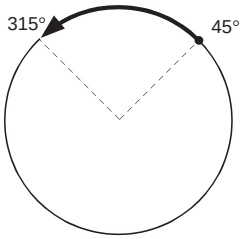
1) Positioning is carried out in a clockwise direction when the current value is moved from 315° to 45°.

2) Positioning is carried out in a counterclockwise direction when the current value is moved from 45° to 315°.

1) Moved from 315° to 45°




2) Moved from 45° to 315°




To designate the positioning direction (not carrying out the shortcut control), the shortcut control is invalidated and positioning in a designated direction is carried out by the "[Cd.40] ABS direction in degrees".

This function can perform only when the software stroke limit is invalid. When the software stroke limit is valid, the error "Illegal setting of ABS direction in unit of degree" (error code: 19A5H) occurs and positioning is not started.

To designate the movement direction in the ABS control, a "1" or "2" is written to the "[Cd.40] ABS direction in degrees" of the buffer memory (initial value: 0).

The value written to the "[Cd.40] ABS direction in degrees" becomes valid only when the positioning control is started.

In the continuous positioning control and continuous path control, the operation is continued with the setting set at the time of start even if the setting is changed during the operation.

n: Axis No. - 1

| Name | Function | Buffer memory address | Initial value |
|---|---|---|---|
| [Cd.40]<br>ABS direction in degrees | The ABS movement direction in the unit of degree is designated.<br>0: Shortcut (direction setting invalid)<br>1: ABS clockwise<br>2: ABS counterclockwise | 4350+100n | 0 |

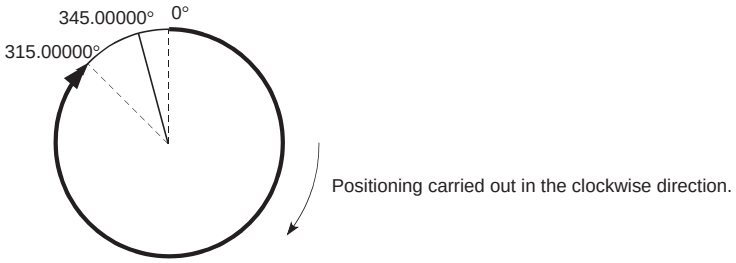
### ■Absolute system (When the software stroke limit is valid)

The positioning is carried out in a clockwise/counterclockwise direction depending on the software stroke limit range setting method.

Because of this, positioning with "shortcut control" may not be possible.

**Ex.**

When the current value is moved from 0° to 315°, positioning is carried out in the clockwise direction if the software stroke limit lower limit value is 0° and the upper limit value is 345°.




**Point**

Positioning addresses are within a range of 0° to 359.99999°.

Use the incremental system to carry out positioning of one rotation or more.

### ■Incremental system

Positioning is carried out for a designated movement amount in a designated movement direction when in the incremental system of positioning.

The movement direction is determined by the sign (+, -) of the movement amount.

| | |
|---|---|
| For a positive (+) movement direction | Clockwise |
| For a negative (-) movement direction | Counterclockwise |

**Point**

Positioning of 360° or more can be carried out with the incremental system.
At this time, set as shown below to invalidate the software stroke limit.
[Software stroke limit upper limit value = Software stroke limit lower limit value]
Set the value within the setting range (0° to 359.99999°).

# Interpolation control

## Meaning of interpolation control

In "2-axis linear interpolation control", "3-axis linear interpolation control", "4-axis linear interpolation control", "2-axis fixed-feed control", "3-axis fixed-feed control", "4-axis fixed-feed control", "2-axis speed control", "3-axis speed control", "4-axis speed control", "2-axis circular interpolation control", and "3-axis helical interpolation control", each control is performed so that linear and arc paths are drawn using a motor set in two to four axis directions. This kind of control is called "interpolation control".

In interpolation control, the axis in which the control method is set is defined as the "reference axis", and the other axis is defined as the "interpolation axis".

The Simple Motion module controls the "reference axis" following the positioning data set in the "reference axis", and controls the "interpolation axis" corresponding to the reference axis control so that a linear or arc path is drawn.

The following table shows the reference axis and interpolation axis combinations.

—: Setting not required (The setting value is invalid. Use the initial value or a value within the setting range.)

<table>
<tr><th rowspan="2">Interpolation control set in "[Da.2] Control method"</th><th colspan="2">RD77MS2</th><th colspan="2">RD77MS4/RD77MS8/RD77MS16</th></tr>
<tr><th>Reference axis</th><th>Interpolation axis</th><th>Reference axis</th><th>Interpolation axis</th></tr>
<tr><td>2-axis linear interpolation control<br>2-axis fixed-feed control<br>2-axis circular interpolation control<br>2-axis speed control</td><td>Any of axes 1 to 2</td><td>"Axis to be interpolated No.1" set in reference axis</td><td rowspan="5">RD77MS4:<br>Any of axes 1 to 4<br>RD77MS8:<br>Any of axes 1 to 8<br>RD77MS16:<br>Any of axes 1 to 16</td><td>"Axis to be interpolated No.1" set in reference axis</td></tr>
<tr><td rowspan="4">3-axis linear interpolation control<br>3-axis fixed-feed control<br>3-axis speed control</td><td colspan="2">—</td><td rowspan="4">"Axis to be interpolated No.1" and "Axis to be interpolated No.2" set in reference axis</td></tr>
<tr><td colspan="2">—</td></tr>
<tr><td colspan="2">—</td></tr>
<tr><td colspan="2">—</td></tr>
<tr><td rowspan="4">4-axis linear interpolation control<br>4-axis fixed-feed control<br>4-axis speed control</td><td colspan="2">—</td><td rowspan="4">"Axis to be interpolated No.1", "Axis to be interpolated No.2" and "Axis to be interpolated No.3" set in reference axis</td></tr>
<tr><td colspan="2">—</td></tr>
<tr><td colspan="2">—</td></tr>
<tr><td colspan="2">—</td></tr>
</table>

The combinations of axes available for the 3-axis helical interpolation control are the same as the ones for the "3-axis linear interpolation control", "3-axis fixed-feed control", and "3-axis speed control". The following table shows the combinations of the reference axis, circular interpolation axis, and linear interpolation axis for the 3-axis helical interpolation control.

<table>
<tr><th rowspan="2">Interpolation control set in "[Da.2] Control method"</th><th colspan="3">RD77MS2</th><th colspan="3">RD77MS4/RD77MS8/RD77MS16</th></tr>
<tr><th>Reference axis</th><th>Circular interpolation axis</th><th>Linear interpolation axis</th><th>Reference axis</th><th>Circular interpolation axis</th><th>Linear interpolation axis</th></tr>
<tr><td>3-axis helical interpolation control</td><td colspan="3">—</td><td>RD77MS4:<br>Any of axes 1 to 4<br>RD77MS8:<br>Any of axes 1 to 8<br>RD77MS16:<br>Any of axes 1 to 16</td><td>"Axis to be interpolated No.1" set in reference axis</td><td>"Axis to be interpolated No.2" set in reference axis</td></tr>
</table>

## Setting the positioning data

When carrying out interpolation control, the same positioning data Nos. are set for the "reference axis" and the "interpolation axis". The following table shows the "positioning data" setting items for the reference axis and interpolation axis.

◎: Setting always required, ○: Set according to requirements (Set to "—" when not used.), △: Setting restrictions exist

—: Setting not required (The setting value is invalid. Use the initial value or a value within the setting range.)

| Setting item | | | Reference axis setting item | Interpolation axis setting item |
|---|---|---|---|---|
| Same positioning data Nos | [Da.1] | Operation pattern | ◎ | — |
| | [Da.2] | Control method | ◎<br>Linear 2, 3, 4<br>Fixed-feed 2, 3, 4<br>Circular sub, Circular right, Circular left<br>Helical sub, Helical right, Helical left<br>Forward run speed 2, 3, 4<br>Reverse run speed 2, 3, 4 | — |
| | [Da.3] | Acceleration time No. | ◎ | — |
| | [Da.4] | Deceleration time No. | ◎ | — |
| | [Da.6] | Positioning address/movement amount | △<br>(Forward run speed 2, 3, and 4. Reverse run speed 2, 3, and 4 not required.) | △<br>(Forward run speed 2, 3, and 4. Reverse run speed 2, 3, and 4 not required.) |
| | [Da.7] | Arc address | △<br>(Only during circular sub, circular right, circular left, helical sub, helical right, and helical left.) | △<br>(Only during circular sub, circular right, circular left, helical sub, helical right, and helical left.) |
| | [Da.8] | Command speed | ◎ | △<br>(Only during forward run speed 2, 3, 4 and reverse run speed 2, 3, 4). |
| | [Da.9] | Dwell time/JUMP destination positioning data No. | ○ | — |
| | [Da.10] | M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches | ○ | —<br>Set the number of pitch for the linear interpolation axis only during helical sub, helical right, and helical left. |
| | [Da.20] | Axis to be interpolated No.1 | ○*1 | — |
| | [Da.21] | Axis to be interpolated No.2 | ○*1 | — |
| | [Da.22] | Axis to be interpolated No.3 | ○*1 | — |
| | [Da.27] | M code ON signal output timing | ○ | — |
| | [Da.28] | ABS direction in degrees | ○ | — |
| | [Da.29] | Interpolation speed designation method | △ | — |

*1 The axis No. is set to axis to be interpolated No.1 for 2-axis linear interpolation, to axis to be interpolated No.1 and No.2 for 3-axis linear interpolation, and to axis to be interpolated No.1 to No.3 for 4-axis linear interpolation.
If the self-axis is set, the error "Illegal interpolation description command" (error code: 1A22H) will occur. The axes that are not used are not required.

*2 Refer to the following for information on the setting details.
☞ Page 445 Positioning Data

## Starting the interpolation control

The positioning data Nos. of the reference axis (axis in which interpolation control was set in "[Da.2] Control method") are started when starting the interpolation control. (Starting of the interpolation axis is not required.)

The following errors or warnings will occur and the positioning will not start if both reference axis and the interpolation axis are started.

- Reference axis: Interpolation while interpolation axis BUSY (error code: 1998H)
- Interpolation axis: Control method setting error (error code: 199CH), start during operation (warning code: 0900H).

## Interpolation control continuous positioning

When carrying out interpolation control in which "continuous positioning control" and "continuous path control" are designated in the operation pattern, the positioning method for all positioning data from the started positioning data to the positioning data in which "positioning complete" is set must be set to interpolation control.

The number of the interpolation axes and axes to be interpolated cannot be changed from the intermediate positioning data. When the number of the interpolation axes and axes to be interpolated are changed, the error "Control method setting error" (error code: 199CH) will occur and the positioning will stop.

## Speed during interpolation control

Either the "composite speed" or "reference axis speed" can be designated as the speed during interpolation control. ([Pr.20] Interpolation speed designation method)

Only the "Reference axis speed" can be designated in the following interpolation control.

When a "composite speed" is set and positioning is started, the error "Interpolation mode error" (error code: 199AH) occurs, and the system will not start.

- 4-axis linear interpolation
- 2-axis speed control
- 3-axis speed control
- 4-axis speed control

## Cautions

- If any axis exceeds "[Pr.8] Speed limit value" during 2- to 4-axis speed control, the axis exceeding the speed limit value is controlled with the speed limit value. The speeds of the other axes being interpolated suppressed by the command speed ratio.
- If the reference axis exceeds "[Pr.8] Speed limit value" during 2-axis circular interpolation control, the reference axis is controlled with the speed limit value. (The speed limit does not function on the interpolation axis side.)
- If any axis exceeds "[Pr.8] Speed limit value" during 2- to 4-axis linear interpolation control or 2- to 4-axis fixed-feed control, the axis exceeding the speed limit value is controlled with the speed limit value. The speeds of the other axes being interpolated are suppressed by the movement amount ratio.
- In the 3-axis helical interpolation control, the composite speed of the circular interpolation axis or the speed of the linear interpolation axis is controlled not to exceed "[Pr.8] Speed limit value". (However, when the movement amount of the linear interpolation axis is more than the composite movement amount of the circular interpolation axis, such as when the number of pitches ("[Da.10] M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches") set in the linear interpolation axis is less, the speed of the linear interpolation axis cannot be suppressed with "[Pr.8] Speed limit value".)
- In 2- to 4-axis interpolation, you cannot change the combination of interpolated axes midway through operation.

**Point**

When the "reference axis speed" is set during interpolation control, set so the major axis side becomes the reference axis. If the minor axis side is set as the reference axis, the major axis side speed may exceed the "[Pr.8] Speed limit value".

## Limits to interpolation control

There are limits to the interpolation control that can be executed and speed ([Pr.20] Interpolation speed designation method) that can be set, depending on the "[Pr.1] Unit setting" of the reference axis and interpolation axis. (For example, circular interpolation control cannot be executed if the reference axis and interpolation axis units differ.)

The following table shows the interpolation control and speed designation limits.

○: Setting possible, ×: Setting not possible.

| Interpolation control set in "[Da.2] Control method" | [Pr.20] Interpolation speed designation method | [Pr.1] Unit setting*1 | |
|---|---|---|---|
| | | Reference axis and interpolation axis units are the same, or a combination of "mm" and "inch".*3 | Reference axis and interpolation axis units differ*3 |
| Linear 2 (ABS, INC)<br>Fixed-feed 2 | Composite speed | ○ | × |
| | Reference axis speed | ○ | ○ |
| Circular sub (ABS, INC)<br>Circular right (ABS, INC)<br>Circular left (ABS, INC) | Composite speed | ○*2 | × |
| | Reference axis speed | × | × |
| Linear 3 (ABS, INC)<br>Fixed-feed 3 | Composite speed | ○ | × |
| | Reference axis speed | ○ | ○ |
| Linear 4 (ABS, INC)<br>Fixed-feed 4 | Composite speed | × | × |
| | Reference axis speed | ○ | ○ |
| Helical sub (ABS, INC)<br>Helical right (ABS, INC)<br>Helical left (ABS, INC) | Composite speed | ○*2 | ○*4 |
| | Reference axis speed | × | × |

*1 "mm" and "inch" unit mix possible.
When "mm" and "inch" are mixed, convert as follows for the positioning.
If interpolation control units are "mm", positioning is controlled by calculating position commands from the address, travel value, positioning speed and electronic gear, which have been converted to "mm" using the formula: inch setting value × 25.4 = mm setting value.
If interpolation control units are "inch", positioning is controlled by calculating position commands from the address, travel value, positioning speed and electronic gear, which have been converted to "inch" using the formula: mm setting value/25.4 = inch setting value.

*2 "degree" setting not possible.
The error "Circular interpolation not possible" (error code: 199FH) will occur and the positioning control does not start if circular interpolation control and 3-axis helical interpolation control is set when the unit is "degree".
The machine will carry out a deceleration stop if "degree" is set during positioning control.

*3 The unit set in the reference axis will be used for the speed unit during control if the units differ or if "mm" and "inch" are combined.

*4 Only linear interpolation axis can use a unit different from that of the reference axis.

## Axis operation status during interpolation control

"Interpolation" will be stored in the "[Md.26] Axis operation status" during interpolation control. "Standby" will be stored when the interpolation operation is terminated. Both the reference axis and interpolation axis will carry out a deceleration stop if an error occurs during control, and "Error" will be stored in the operation status.

# 3.2 Setting the Positioning Data

## Relation between each control and positioning data

The setting requirements and details for the setting items of the positioning data to be set differ according to the "[Da.2] Control method".

The following table shows the positioning data setting items corresponding to the different types of control.

(In this section, it is assumed that the positioning data setting is carried out using an engineering tool.)

◎: Always set

○: Set as required ("—" when not required)

×: Setting not possible (If set, the error "Continuous path control not possible" (error code: 1A1EH to 1A20H) will occur at start.)

△: Setting limited

—: Setting not required (The setting value is invalid. Use the initial value or a value within the setting range.)

| Positioning data | | | Position control | | | | 1 to 4 axis speed control |
|---|---|---|---|---|---|---|---|
| | | | 1-axis linear control 2/3/4-axis linear interpolation control | 1-axis fixed-feed control, 2/3/4-axis fixed-feed control | 2-axis circular interpolation control | 3-axis helical interpolation control | |
| [Da.1] | Operation pattern | Independent positioning control (Positioning complete) | ◎ | ◎ | ◎ | ◎ | ◎ |
| | | Continuous positioning control | ◎ | ◎ | ◎ | ◎ | × |
| | | Continuous path control | ◎ | × | ◎ | ◎ | × |
| [Da.2] | Control method | | Linear 1<br>Linear 2<br>Linear 3<br>Linear 4<br>*1 | Fixed- feed 1<br>Fixed- feed 2<br>Fixed- feed 3<br>Fixed- feed 4 | Circular sub<br>Circular right<br>Circular left<br>*1 | Helical sub<br>Helical right<br>Helical left<br>*1 | Forward run speed 1<br>Reverse run speed 1<br>Forward run speed 2<br>Reverse run speed 2<br>Forward run speed 3<br>Reverse run speed 3<br>Forward run speed 4<br>Reverse run speed 4 |
| [Da.3] | Acceleration time No. | | ◎ | ◎ | ◎ | ◎ | ◎ |
| [Da.4] | Deceleration time No. | | ◎ | ◎ | ◎ | ◎ | ◎ |
| [Da.6] | Positioning address/movement amount | | ◎ | ◎ | ◎ | ◎ | — |
| [Da.7] | Arc address | | — | — | ◎ | ◎ | — |
| [Da.8] | Command speed | | ◎ | ◎ | ◎ | ◎ | ◎ |
| [Da.9] | Dwell time/JUMP destination positioning data No. | | ○ | ○ | ○ | ○ | — |
| [Da.10] | M code/Condition data No./ Number of LOOP to LEND repetitions/Number of pitches | | ○ | ○ | ○ | ○*2 | ○ |
| [Da.20] | Axis to be interpolated 1 | | ◎: 2 axes, 3 axes, 4 axes, —: 1 axis | | | ◎ | ◎: 2 axes, 3 axes, 4 axes, —: 1 axis |
| [Da.21] | Axis to be interpolated 2 | | ◎: 3 axes, 4 axes, —: 1 axis, 2 axes | | | ◎ | ◎: 3 axes, 4 axes, —: 1 axis, 2 axes |
| [Da.22] | Axis to be interpolated 3 | | ◎: 4 axes, —: 1 axis, 2 axes, 3 axes | | | — | ◎: 4 axes, —: 1 axis, 2 axes, 3 axes |
| [Da.27] | M code ON signal output timing | | ○ | ○ | ○ | ○ | ○ |
| [Da.28] | ABS direction in degrees | | ○ | ○ | ○ | ○ | ○ |
| [Da.29] | Interpolation speed designation method | | △ | △ | △ | △ | △ |

*1 Two control systems are available: the absolute (ABS) system and incremental (INC) system.

*2 Set an M code for the reference axis and set the number of pitches for the linear interpolation axis.

◎: Always set

○: Set as required ("—" when not required)

×: Setting not possible (If set, the error "Continuous path control not possible" (error code: 1A1EH to 1A20H) will occur at start.)

—: Setting not required (The setting value is invalid. Use the initial value or a value within the setting range.)

| Positioning data | | | Speed-position switching control | Position-speed switching control |
|---|---|---|---|---|
| [Da.1] | Operation pattern | Independent positioning control (Positioning complete) | ◎ | ◎ |
| | | Continuous positioning control | ◎ | × |
| | | Continuous path control | × | × |
| [Da.2] | Control method | | Forward run speed/position<br>Reverse run speed/position<br>*1 | Forward run position/speed<br>Reverse run position/speed |
| [Da.3] | Acceleration time No. | | ◎ | ◎ |
| [Da.4] | Deceleration time No. | | ◎ | ◎ |
| [Da.6] | Positioning address/movement amount | | ◎ | ◎ |
| [Da.7] | Arc address | | — | — |
| [Da.8] | Command speed | | ◎ | ◎ |
| [Da.9] | Dwell time/JUMP destination positioning data No. | | ○ | ○ |
| [Da.10] | M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches | | ○ | ○ |
| [Da.20] | Axis to be interpolated 1 | | — | — |
| [Da.21] | Axis to be interpolated 2 | | — | — |
| [Da.22] | Axis to be interpolated 3 | | — | — |
| [Da.27] | M code ON signal output timing | | ○ | ○ |
| [Da.28] | ABS direction in degrees | | ○ | ○ |
| [Da.29] | Interpolation speed designation method | | — | — |

*1 Two control systems are available: the absolute (ABS) system and incremental (INC) system.

◎: Always set

○: Set as required ("—" when not required)

×: Setting not possible (If set, the error "Continuous path control not possible" (error code: 1A1EH to 1A20H) will occur at start.)

—: Setting not required (The setting value is invalid. Use the initial value or a value within the setting range.)

| Positioning data | | | Other control | | | | |
|---|---|---|---|---|---|---|---|
| | | | NOP instruction | Current value changing | JUMP instruction | LOOP | LEND |
| [Da.1] | Operation pattern | Independent positioning control (Positioning complete) | — | ◎ | — | — | — |
| | | Continuous positioning control | — | ◎ | — | — | — |
| | | Continuous path control | — | × | — | — | — |
| [Da.2] | Control method | | NOP | Current value changing | JUMP instruction | LOOP | LEND |
| [Da.3] | Acceleration time No. | | — | — | — | — | — |
| [Da.4] | Deceleration time No. | | — | — | — | — | — |
| [Da.6] | Positioning address/movement amount | | — | New address | — | — | — |
| [Da.7] | Arc address | | — | — | — | — | — |
| [Da.8] | Command speed | | — | — | — | — | — |
| [Da.9] | Dwell time/JUMP destination positioning data No. | | — | — | JUMP destination positioning data No. | — | — |
| [Da.10] | M code/Condition data No./ Number of LOOP to LEND repetitions/Number of pitches | | — | ○ | JUMP condition data No. | Number of LOOP to LEND repetitions | — |
| [Da.20] | Axis to be interpolated 1 | | — | — | — | — | — |
| [Da.21] | Axis to be interpolated 2 | | — | — | — | — | — |
| [Da.22] | Axis to be interpolated 3 | | — | — | — | — | — |
| [Da.27] | M code ON signal output timing | | — | ○ | — | — | — |
| [Da.28] | ABS direction in degrees | | ○ | ○ | ○ | ○ | ○ |
| [Da.29] | Interpolation speed designation method | | — | — | — | — | — |

**Point**

It is recommended that the "positioning data" be set whenever possible with an engineering tool. Execution by a program uses many programs and devices. The execution becomes complicated, and the scan times will increase.

# 1-axis linear control

In "1-axis linear control" ("[Da.2] Control method" = ABS linear 1, INC linear 1), one motor is used to carry out position control in a set axis direction.

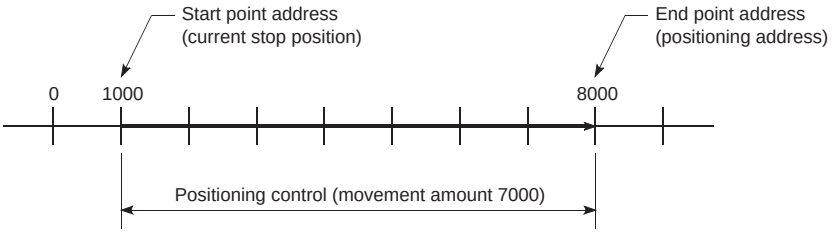
## 1-axis linear control (ABS linear 1)

### ■Operation chart

In absolute system 1-axis linear control, positioning is carried out from the current stop position (start point address) to the address (end point address) set in "[Da.6] Positioning address/movement amount".

Ex.

When the start point address (current stop position) is 1000, and the end point address (positioning address) is 8000, positioning is carried out in the positive direction for a movement amount of 7000 (8000 - 1000)




### ■Setting positioning data

When using 1-axis linear control (ABS linear 1), set the following positioning data.

◎: Always set, ○: Set as required, △: Setting restricted, —: Setting not required

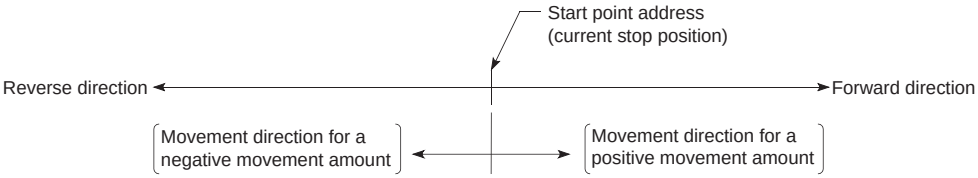
| Setting item | | Setting required/not required |
|---|---|---|
| [Da.1] | Operation pattern | ◎ |
| [Da.2] | Control method | ◎<br>(Set ABS linear 1.) |
| [Da.3] | Acceleration time No. | ○ |
| [Da.4] | Deceleration time No. | ○ |
| [Da.6] | Positioning address/movement amount | ◎ |
| [Da.7] | Arc address | — |
| [Da.8] | Command speed | ◎ |
| [Da.9] | Dwell time/JUMP destination positioning data No. | ○ |
| [Da.10] | M code/Condition data No./Number of LOOP to LEND repetitions/ Number of pitches | ○ |
| [Da.20] | Axis to be interpolated No.1 | — |
| [Da.21] | Axis to be interpolated No.2 | — |
| [Da.22] | Axis to be interpolated No.3 | — |
| [Da.27] | M code ON signal output timing | ○ |
| [Da.28] | ABS direction in degrees | ○ |
| [Da.29] | Interpolation speed designation method | △ |

*1 Refer to the following for information on the setting details.
☞ Page 445 Positioning Data

## 1-axis linear control (INC linear 1)

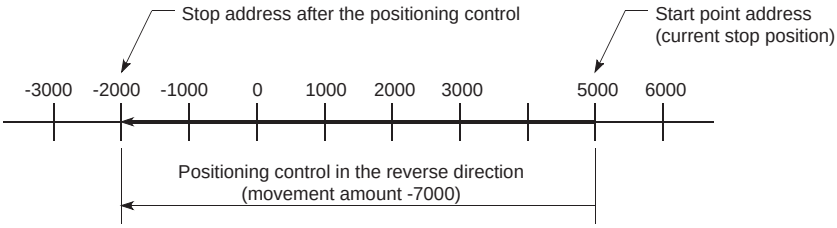
### ■Operation chart

In incremental system 1-axis linear control, positioning is carried out from the current stop position (start point address) to a position at the end of the movement amount set in "[Da.6] Positioning address/movement amount". The movement direction is determined by the sign of the movement amount.




**Ex.**

When the start point address is 5000, and the movement amount is -7000, positioning is carried out to the -2000 position.




### ■Setting positioning data

When using 1-axis linear control (INC linear 1), set the following positioning data.

◎: Always set, ○: Set as required, △: Setting restricted, —: Setting not required

| Setting item | | Setting required/not required |
|---|---|---|
| [Da.1] | Operation pattern | ◎ |
| [Da.2] | Control method | ◎<br>(Set INC linear 1.) |
| [Da.3] | Acceleration time No. | ○ |
| [Da.4] | Deceleration time No. | ○ |
| [Da.6] | Positioning address/movement amount | ◎ |
| [Da.7] | Arc address | — |
| [Da.8] | Command speed | ◎ |
| [Da.9] | Dwell time/JUMP destination positioning data No. | ○ |
| [Da.10] | M code/Condition data No./Number of LOOP to LEND repetitions/ Number of pitches | ○ |
| [Da.20] | Axis to be interpolated No.1 | — |
| [Da.21] | Axis to be interpolated No.2 | — |
| [Da.22] | Axis to be interpolated No.3 | — |
| [Da.27] | M code ON signal output timing | ○ |
| [Da.28] | ABS direction in degrees | ○ |
| [Da.29] | Interpolation speed designation method | △ |

*1 Refer to the following for information on the setting details.
☞ Page 445 Positioning Data

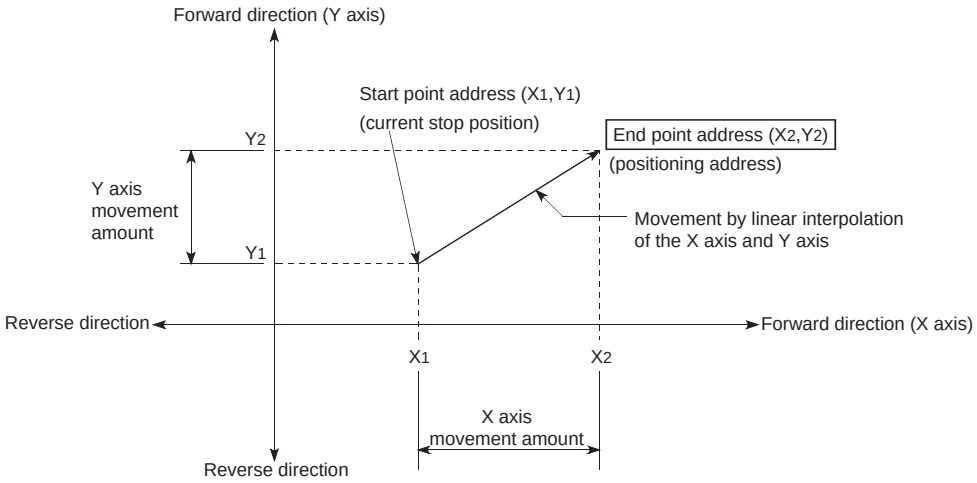
# 2-axis linear interpolation control

In "2-axis linear interpolation control" ("[Da.2] Control method" = ABS linear 2, INC linear 2), two motors are used to carry out position control in a linear path while carrying out interpolation for the axis directions set in each axis. (Refer to ☞ Page 64 Interpolation control for details on interpolation control.)

## 2-axis linear interpolation control (ABS linear 2)

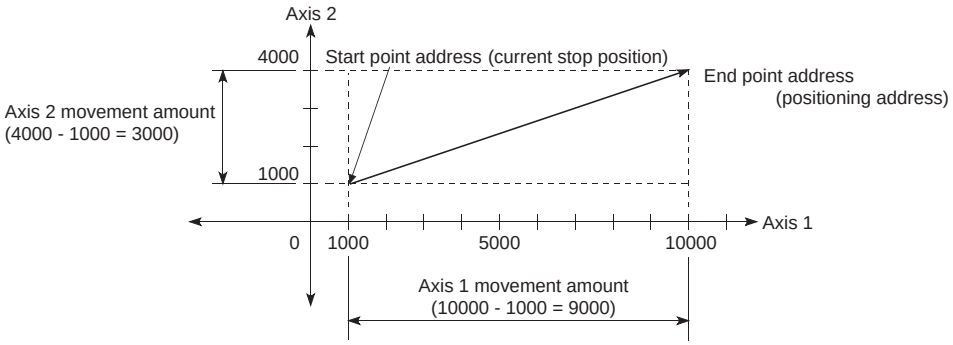
### ■Operation chart

In absolute system 2-axis linear interpolation control, the designated 2 axes are used. Linear interpolation positioning is carried out from the current stop position (start point address) to the address (end point address) set in "[Da.6] Positioning address/movement amount".




**Ex.**

When the start point address (current stop position) is (1000, 1000) and the end point address (positioning address) is (10000, 4000), positioning is carried out as follows.




### ■Restrictions

An error will occur and the positioning will not start in the following cases. The machine will immediately stop if the error is detected during a positioning control.

- If the movement amount of each axis exceeds "1073741824 (= $2^{30}$)" when "0: Composite speed" is set in "[Pr.20] Interpolation speed designation method", the error "Outside linear movement amount range" (error code: 1A15H, 1A16H) occurs at a positioning start. (The maximum movement amount that can be set in "[Da.6] Positioning address/movement amount" is "1073741824 (= $2^{30}$)".)

## ■Setting positioning data

When using 2-axis linear interpolation control (ABS linear 2), set the following positioning data.

◎: Always set, ○: Set as required, △: Setting restricted, —: Setting not required

| Setting item | | Setting required/not required for the reference axis | Setting required/not required for the interpolation axis |
|---|---|---|---|
| [Da.1] | Operation pattern | ◎ | — |
| [Da.2] | Control method | ◎<br>(Set ABS linear 2.) | — |
| [Da.3] | Acceleration time No. | ○ | — |
| [Da.4] | Deceleration time No. | ○ | — |
| [Da.6] | Positioning address/movement amount | ◎ | ◎ |
| [Da.7] | Arc address | — | — |
| [Da.8] | Command speed | ◎ | — |
| [Da.9] | Dwell time/JUMP destination positioning data No. | ○ | — |
| [Da.10] | M code/Condition data No./Number of LOOP to LEND repetitions/ Number of pitches | ○ | — |
| [Da.20] | Axis to be interpolated No.1 | ◎ | — |
| [Da.21] | Axis to be interpolated No.2 | — | — |
| [Da.22] | Axis to be interpolated No.3 | — | — |
| [Da.27] | M code ON signal output timing | ○ | — |
| [Da.28] | ABS direction in degrees | ○ | — |
| [Da.29] | Interpolation speed designation method | △ | — |

*1 Refer to the following for information on the setting details.
☞ Page 445 Positioning Data

**Restriction**

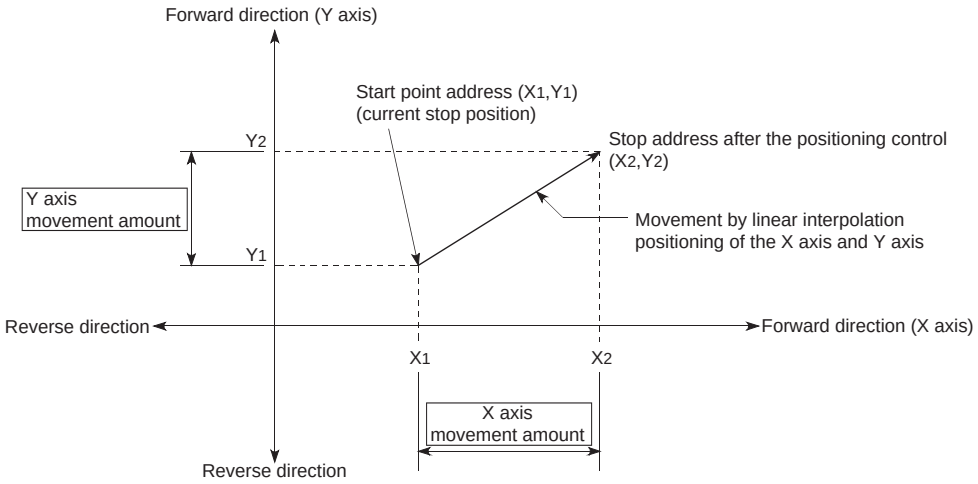
When the "reference axis speed" is set during 2-axis linear interpolation control, set so the major axis side becomes the reference axis. If the minor axis side is set as the reference axis, the major axis side speed may exceed the "[Pr.8] Speed limit value".

## 2-axis linear interpolation control (INC linear 2)

### ■Operation chart

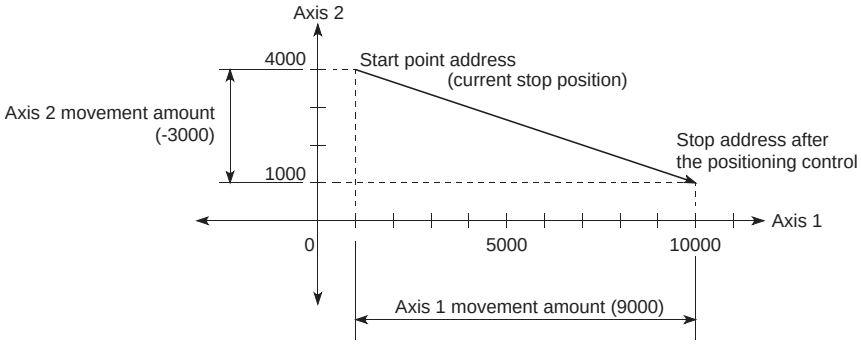
In incremental system 2-axis linear interpolation control, the designated 2 axes are used. Linear interpolation positioning is carried out from the current stop position (start point address) to a position at the end of the movement amount set in "[Da.6] Positioning address/movement amount". The movement direction is determined by the sign of the movement amount.

- Positive movement amount: Positioning control to forward direction (Address increase direction)
- Negative movement amount: Positioning control to reverse direction (Address decrease direction)




**Ex.**

When the axis 1 movement amount is 9000 and the axis 2 movement amount is -3000, positioning address (10000, 4000) is carried out as follows.




### ■Restrictions

An error will occur and the positioning will not start in the following cases. The machine will immediately stop if the error is detected during a positioning operation.

- If the movement amount of each axis exceeds "1073741824 (= $2^{30}$)" when "0: Composite speed" is set in "[Pr.20] Interpolation speed designation method", the error "Outside linear movement amount range" (error code: 1A15H, 1A16H) occurs at a positioning start. (The maximum movement amount that can be set in "[Da.6] Positioning address/movement amount" is "1073741824 (= $2^{30}$)".)

## ■Setting positioning data

When using 2-axis linear interpolation control (INC linear 2), set the following positioning data.

◎: Always set, ○: Set as required, △: Setting restricted, —: Setting not required

| Setting item | | Setting required/not required for the reference axis | Setting required/not required for the interpolation axis |
|---|---|---|---|
| [Da.1] | Operation pattern | ◎ | — |
| [Da.2] | Control method | ◎<br>(Set INC linear 2.) | — |
| [Da.3] | Acceleration time No. | ○ | — |
| [Da.4] | Deceleration time No. | ○ | — |
| [Da.6] | Positioning address/movement amount | ◎ | ◎ |
| [Da.7] | Arc address | — | — |
| [Da.8] | Command speed | ◎ | — |
| [Da.9] | Dwell time/JUMP destination positioning data No. | ○ | — |
| [Da.10] | M code/Condition data No./Number of LOOP to LEND repetitions/ Number of pitches | ○ | — |
| [Da.20] | Axis to be interpolated No.1 | ◎ | — |
| [Da.21] | Axis to be interpolated No.2 | — | — |
| [Da.22] | Axis to be interpolated No.3 | — | — |
| [Da.27] | M code ON signal output timing | ○ | — |
| [Da.28] | ABS direction in degrees | ○ | — |
| [Da.29] | Interpolation speed designation method | △ | — |

*1 Refer to the following for information on the setting details.
☞ Page 445 Positioning Data

**Restriction**

When the "reference axis speed" is set during 2-axis linear interpolation control, set so the major axis side becomes the reference axis. If the minor axis side is set as the reference axis, the major axis side speed may exceed the "[Pr.8] Speed limit value".

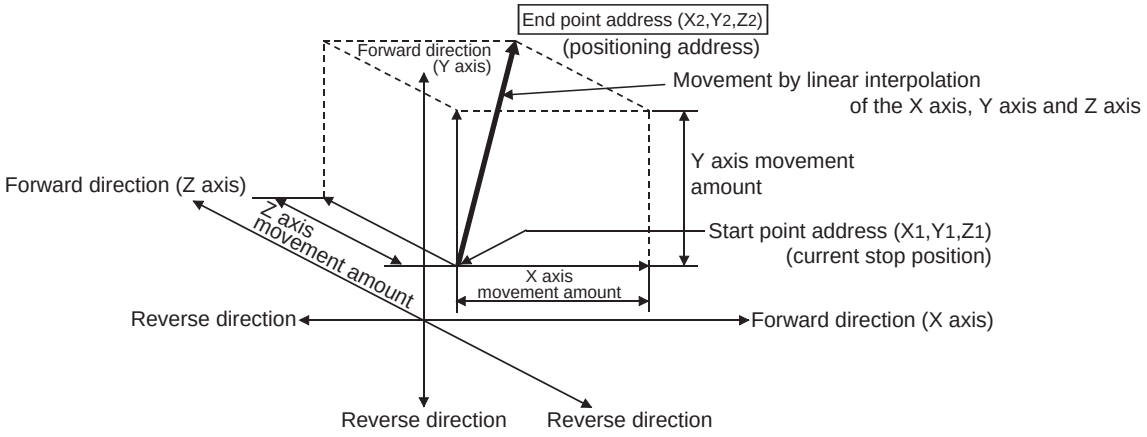
# 3-axis linear interpolation control

In "3-axis linear interpolation control" ("[Da.2] Control method" = ABS linear 3, INC linear 3), three motors are used to carry out position control in a linear path while carrying out interpolation for the axis directions set in each axis.
(Refer to ☞ Page 64 Interpolation control for details on interpolation control.)

## 3-axis linear interpolation control (ABS linear 3)

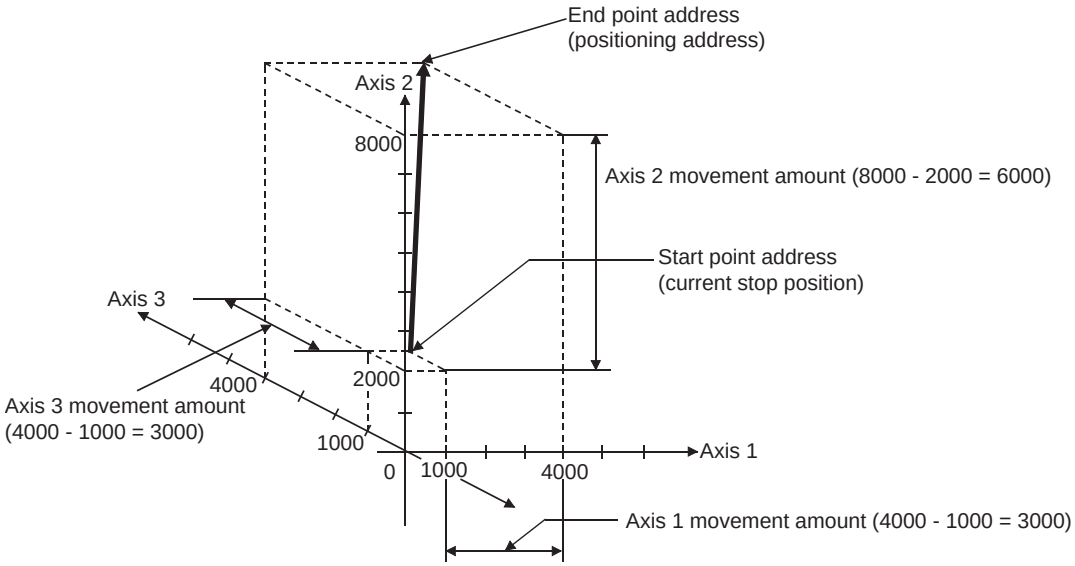
### ■Operation chart

In the absolute system 3-axis linear interpolation control, the designated 3 axes are used. Linear interpolation positioning is carried out from the current stop position (start point address) to the address (end point address) set in the "[Da.6] Positioning address/movement amount".


End point address (X2,Y2,Z2)
(positioning address)
Forward direction (Y axis)
Movement by linear interpolation of the X axis, Y axis and Z axis
Y axis movement amount
Forward direction (Z axis)
Z axis movement amount
Start point address (X1,Y1,Z1)
(current stop position)
X axis movement amount
Reverse direction
Forward direction (X axis)
Reverse direction
Reverse direction

**Ex.**

When the start point address (current stop position) is (1000, 2000, 1000) and the end point address (positioning address) is (4000, 8000, 4000), positioning is carried out as follows.




### ■Restrictions

An error will occur and the positioning will not start in the following cases. The machine will immediately stop if the error is detected during a positioning control.

- If the movement amount of each axis exceeds "1073741824 (= $2^{30}$)" when "0: Composite speed" is set in "[Pr.20] Interpolation speed designation method", the error "Outside linear movement amount range" (error code: 1A15H, 1A16H) occurs at a positioning start. (The maximum movement amount that can be set in "[Da.6] Positioning address/movement amount" is "1073741824 (= $2^{30}$)".)

## ■Setting positioning data

When using 3-axis linear interpolation control (ABS linear 3), set the following positioning data.

◎: Always set, ○: Set as required, △: Setting restricted, —: Setting not required

| Setting item | | Setting required/not required for the reference axis | Setting required/not required for the interpolation axis |
|---|---|---|---|
| [Da.1] | Operation pattern | ◎ | — |
| [Da.2] | Control method | ◎<br>(Set ABS linear 3.) | — |
| [Da.3] | Acceleration time No. | ○ | — |
| [Da.4] | Deceleration time No. | ○ | — |
| [Da.6] | Positioning address/movement amount | ◎ | ◎ |
| [Da.7] | Arc address | — | — |
| [Da.8] | Command speed | ◎ | — |
| [Da.9] | Dwell time/JUMP destination positioning data No. | ○ | — |
| [Da.10] | M code/Condition data No./Number of LOOP to LEND repetitions/ Number of pitches | ○ | — |
| [Da.20] | Axis to be interpolated No.1 | ◎ | — |
| [Da.21] | Axis to be interpolated No.2 | ◎ | — |
| [Da.22] | Axis to be interpolated No.3 | — | — |
| [Da.27] | M code ON signal output timing | ○ | — |
| [Da.28] | ABS direction in degrees | ○ | — |
| [Da.29] | Interpolation speed designation method | △ | — |

*1 Refer to the following for information on the setting details.
☞ Page 445 Positioning Data

**Restriction**

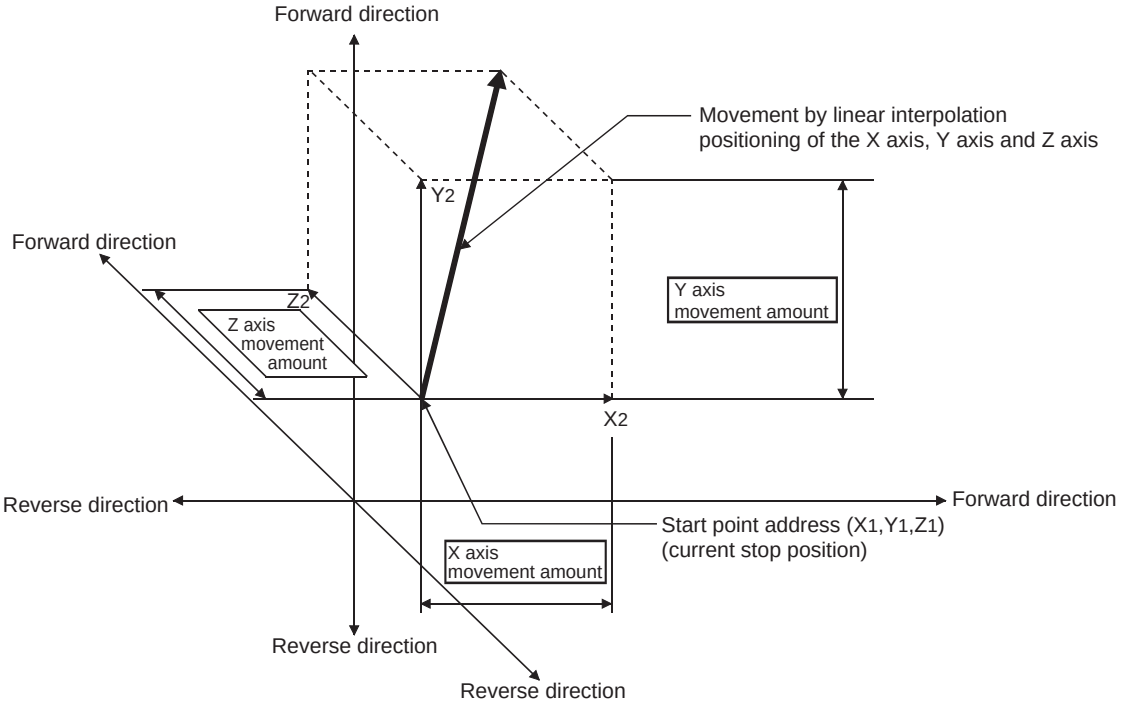
- When the "reference axis speed" is set during 3-axis linear interpolation control, set so the major axis side becomes the reference axis. If the minor axis side is set as the reference axis, the major axis side speed may exceed the "[Pr.8] Speed limit value".
- Refer to ☞ Page 64 Interpolation control for the reference axis and interpolation axis combinations.

## 3-axis linear interpolation control (INC linear 3)

### ■Operation chart

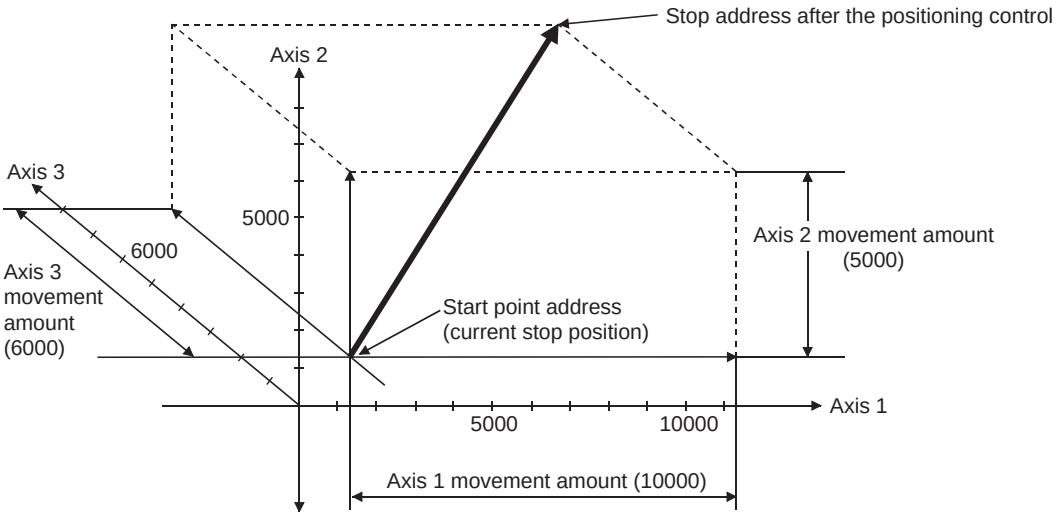
In the incremental system 3-axis linear interpolation control, the designated 3 axes are used. Linear interpolation positioning is carried out from the current stop position (start point address) to a position at the end of the movement amount set in the "[Da.6] Positioning address/movement amount". The movement direction is determined the sign of the movement amount.

- Positive movement amount: Positioning control to forward direction (Address increase direction)
- Negative movement amount: Positioning control to reverse direction (Address decrease direction)




**Ex.**

When the axis 1 movement amount is 10000, the axis 2 movement amount is 5000 and the axis 3 movement amount is 6000, positioning is carried out as follows.




### ■Restrictions

An error will occur and the positioning will not start in the following cases. The machine will immediately stop if the error is detected during a positioning operation.

- If the movement amount of each axis exceeds "1073741824 (= $2^{30}$)" when "0: Composite speed" is set in "[Pr.20] Interpolation speed designation method", the error "Outside linear movement amount range" (error code: 1A15H, 1A16H) occurs at a positioning start. (The maximum movement amount that can be set in "[Da.6] Positioning address/movement amount" is "1073741824 (= $2^{30}$)".)

## ■Setting positioning data

When using 3-axis linear interpolation control (INC linear 3), set the following positioning data.

◎: Always set, ○: Set as required, △: Setting restricted, —: Setting not required

| Setting item | | Setting required/not required for the reference axis | Setting required/not required for the interpolation axis |
|---|---|---|---|
| [Da.1] | Operation pattern | ◎ | — |
| [Da.2] | Control method | ◎<br>(Set INC linear 3.) | — |
| [Da.3] | Acceleration time No. | ○ | — |
| [Da.4] | Deceleration time No. | ○ | — |
| [Da.6] | Positioning address/movement amount | ◎ | ◎ |
| [Da.7] | Arc address | — | — |
| [Da.8] | Command speed | ◎ | — |
| [Da.9] | Dwell time/JUMP destination positioning data No. | ○ | — |
| [Da.10] | M code/Condition data No./Number of LOOP to LEND repetitions/ Number of pitches | ○ | — |
| [Da.20] | Axis to be interpolated No.1 | ◎ | — |
| [Da.21] | Axis to be interpolated No.2 | ◎ | — |
| [Da.22] | Axis to be interpolated No.3 | — | — |
| [Da.27] | M code ON signal output timing | ○ | — |
| [Da.28] | ABS direction in degrees | ○ | — |
| [Da.29] | Interpolation speed designation method | △ | — |

*1 Refer to the following for information on the setting details.
☞ Page 445 Positioning Data

**Restriction**

- When the "reference axis speed" is set during 3-axis linear interpolation control, set so the major axis side becomes the reference axis. If the minor axis side is set as the reference axis, the major axis side speed may exceed the "[Pr.8] Speed limit value".
- Refer to ☞ Page 64 Interpolation control for the reference axis and interpolation axis combinations.

# 4-axis linear interpolation control

In "4-axis linear interpolation control" ("[Da.2] Control method" = ABS linear 4, INC linear 4), four motors are used to carry out position control in a linear path while carrying out interpolation for the axis directions set in each axis. (Refer to ☞ Page 64 Interpolation control for details on interpolation control.)

## 4-axis linear interpolation control (ABS linear 4)

In the absolute system 4-axis linear interpolation control, the designated 4 axes are used. Linear interpolation positioning is carried out from the current stop position (start point address) to the address (end point address) set in the "[Da.6] Positioning address/movement amount".



### ■Setting positioning data

When using 4-axis linear interpolation control (ABS linear 4), set the following positioning data.

◎: Always set, ○: Set as required, △: Setting restricted, —: Setting not required

| Setting item | | Setting required/not required for the reference axis | Setting required/not required for the interpolation axis |
|---|---|---|---|
| [Da.1] | Operation pattern | ◎ | — |
| [Da.2] | Control method | ◎<br>(Set ABS linear 4.) | — |
| [Da.3] | Acceleration time No. | ○ | — |
| [Da.4] | Deceleration time No. | ○ | — |
| [Da.6] | Positioning address/movement amount | ◎ | ◎ |
| [Da.7] | Arc address | — | — |
| [Da.8] | Command speed | ◎ | — |
| [Da.9] | Dwell time/JUMP destination positioning data No. | ○ | — |
| [Da.10] | M code/Condition data No./Number of LOOP to LEND repetitions/ Number of pitches | ○ | — |
| [Da.20] | Axis to be interpolated No.1 | ◎ | — |
| [Da.21] | Axis to be interpolated No.2 | ◎ | — |
| [Da.22] | Axis to be interpolated No.3 | ◎ | — |
| [Da.27] | M code ON signal output timing | ○ | — |
| [Da.28] | ABS direction in degrees | ○ | — |
| [Da.29] | Interpolation speed designation method | △ | — |

*1 Refer to the following for information on the setting details.
☞ Page 445 Positioning Data

**Restriction**

- When the "reference axis speed" is set during 4-axis linear interpolation control, set so the major axis side becomes the reference axis. If the minor axis side is set as the reference axis, the major axis side speed may exceed the "[Pr.8] Speed limit value".
- Refer to ☞ Page 64 Interpolation control for the reference axis and interpolation axis combinations.

## 4-axis linear interpolation control (INC linear 4)

In the incremental system 4-axis linear interpolation control, the designated 4 axes are used. Linear interpolation positioning is carried out from the current stop position (start point address) to a position at the end of the movement amount set in the "[Da.6] Positioning address/movement amount". The movement direction is determined by the sign of the movement amount.

### ■Restrictions

An error will occur and the positioning will not start in the following cases. The machine will immediately stop if the error is detected during a positioning operation.

- When the movement amount for each axis exceeds "1073741824 (= $2^{30}$)", the error "Outside linear movement amount range" (error code: 1A15H, 1A16H) will occur at the positioning start. (The maximum movement amount that can be set in "[Da.6] Positioning address/movement amount" is "1073741824 (= $2^{30}$)".)

### ■Setting positioning data

When using 4-axis linear interpolation control (INC linear 4), set the following positioning data.

◎: Always set, ○: Set as required, △: Setting restricted, —: Setting not required

| Setting item | | Setting required/not required for the reference axis | Setting required/not required for the interpolation axis |
|---|---|---|---|
| [Da.1] | Operation pattern | ◎ | — |
| [Da.2] | Control method | ◎<br>(Set INC linear 4.) | — |
| [Da.3] | Acceleration time No. | ○ | — |
| [Da.4] | Deceleration time No. | ○ | — |
| [Da.6] | Positioning address/movement amount | ◎ | ◎ |
| [Da.7] | Arc address | — | — |
| [Da.8] | Command speed | ◎ | — |
| [Da.9] | Dwell time/JUMP destination positioning data No. | ○ | — |
| [Da.10] | M code/Condition data No./Number of LOOP to LEND repetitions/ Number of pitches | ○ | — |
| [Da.20] | Axis to be interpolated No.1 | ◎ | — |
| [Da.21] | Axis to be interpolated No.2 | ◎ | — |
| [Da.22] | Axis to be interpolated No.3 | ◎ | — |
| [Da.27] | M code ON signal output timing | ○ | — |
| [Da.28] | ABS direction in degrees | ○ | — |
| [Da.29] | Interpolation speed designation method | △ | — |

*1 Refer to the following for information on the setting details.
☞ Page 445 Positioning Data

**Restriction**

- When the "reference axis speed" is set during 4-axis linear interpolation control, set so the major axis side becomes the reference axis. If the minor axis side is set as the reference axis, the major axis side speed may exceed the "[Pr.8] Speed limit value".
- Refer to ☞ Page 64 Interpolation control for the reference axis and interpolation axis combinations.

# Fixed-feed control

In "fixed-feed control" ("[Da.2] Control method" = fixed-feed 1, fixed-feed 2, fixed-feed 3, fixed-feed 4), the motor of the specified axis is used to carry out fixed-feed control in a set axis direction.
In fixed-feed control, any remainder of below control accuracy is rounded down to convert the movement amount designated in the positioning data into the command value to servo amplifier.

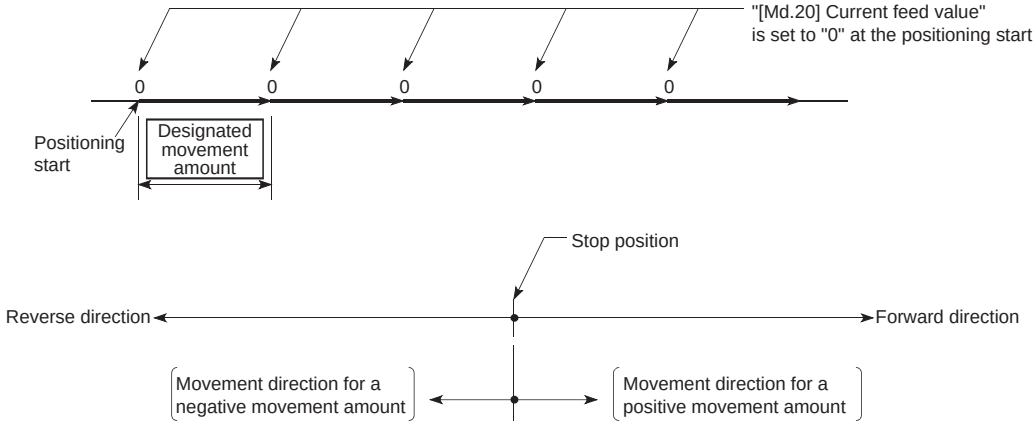
## Operation chart

In fixed-feed control, the address ([Md.20] Current feed value) of the current stop position (start point address) is set to "0". Positioning is then carried out to a position at the end of the movement amount set in "[Da.6] Positioning address/movement amount". The movement direction is determined by the movement amount sign.

- Positive movement amount: Positioning control to forward direction (Address increase direction)
- Negative movement amount: Positioning control to reverse direction (Address decrease direction)

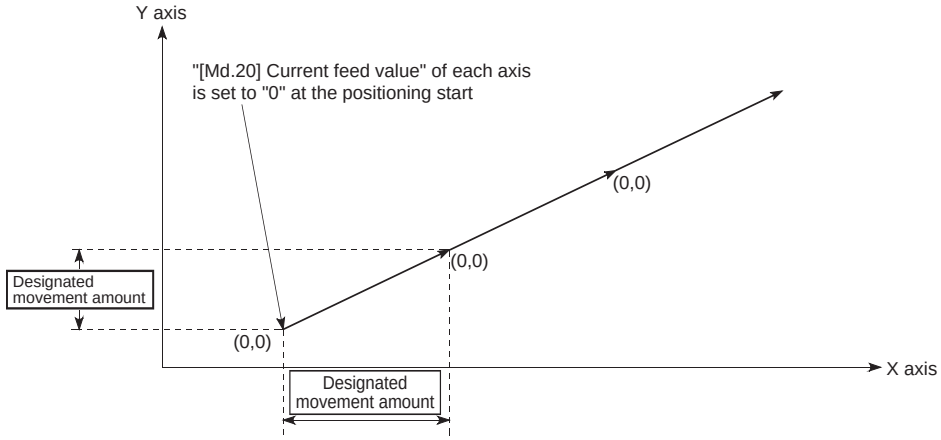
**Ex.**

1-axis fixed-feed control




**Ex.**

2-axis fixed-feed control



## ■Restrictions

- The error "Continuous path control not possible" (error code: 1A1EH to 1A20H) will occur and the operation cannot start if "continuous path control" is set in "[Da.1] Operation pattern". ("Continuous path control" cannot be set in fixed-feed control.)
- "Fixed-feed" cannot be set in "[Da.2] Control method" in the positioning data when "continuous path control" has been set in "[Da.1] Operation pattern" of the immediately prior positioning data. (For example, if the operation pattern of positioning data No. 1 is "continuous path control", fixed-feed control cannot be set in positioning data No. 2.) The error "Continuous path control not possible" (error code: 1A1EH to 1A20H) will occur and the machine will carry out a deceleration stop if this type of setting is carried out.
- In 2- or 3-axis fixed-feed control, if the movement amount of each axis exceeds "1073741824 (=$2^{30}$)" when "0: Composite speed" is set in "[Pr.20] Interpolation speed designation method", the error "Outside linear movement amount range" (error code: 1A15H, 1A16H) occurs at a positioning start and the positioning cannot be started. (The maximum movement amount that can be set in "[Da.6] Positioning address/movement amount" is "1073741824 (= $2^{30}$)".
- In 4-axis fixed-feed control, set "1: Reference axis speed" in "[Pr.20] Interpolation speed designation method". If "0: Composite speed" is set, the error "Interpolation mode error" (error code: 199AH) occurs and the positioning cannot be started.

## Setting positioning data

When using fixed-feed control (fixed-feed 1), set the following positioning data.

◎: Always set, ○: Set as required, △: Setting restricted, —: Setting not required

| Setting item | | Setting required/not required for the reference axis | Setting required/not required for the interpolation axis |
|---|---|---|---|
| [Da.1] | Operation pattern | ◎ | — |
| [Da.2] | Control method | ◎ | — |
| [Da.3] | Acceleration time No. | ○ | — |
| [Da.4] | Deceleration time No. | ○ | — |
| [Da.6] | Positioning address/movement amount | ◎ | ◎ |
| [Da.7] | Arc address | — | — |
| [Da.8] | Command speed | ◎ | — |
| [Da.9] | Dwell time/JUMP destination positioning data No. | ○ | — |
| [Da.10] | M code/Condition data No./Number of LOOP to LEND repetitions/ Number of pitches | ○ | — |
| [Da.20] | Axis to be interpolated No.1 | —*1 | — |
| [Da.21] | Axis to be interpolated No.2 | —*1 | — |
| [Da.22] | Axis to be interpolated No.3 | —*1 | — |
| [Da.27] | M code ON signal output timing | ○ | — |
| [Da.28] | ABS direction in degrees | ○ | — |
| [Da.29] | Interpolation speed designation method | △ | — |

*1 To use the 2- to 4-axis fixed-feed control (interpolation), it is required to set the axis used as the interpolation axis.
Refer to the following for information on the setting details.
☞ Page 445 Positioning Data

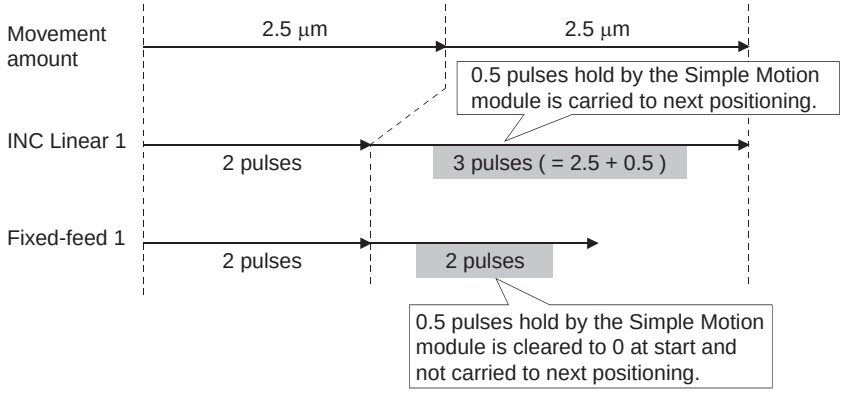
**Point**

When the movement amount is converted to the actual number of command pulses, a fraction appears after the decimal point, according to the movement amount per pulse. This fraction is normally retained in the Simple Motion module and reflected at the next positioning. For the fixed-feed control, since the movement distance is maintained constant (= the command number of pulses is maintained constant), the control is carried out after the fraction pulse is cleared to zero at start.

[Accumulation/cutoff for fractional pulses]

When movement amount per pulse is 1.0 [μm] and movement for 2.5 [μm] is executed two times.

→ Conversion to command pulses: 2.5 [μm]/1.0 = 2.5 [pulse]


Movement amount
2.5 μm
2.5 μm
0.5 pulses hold by the Simple Motion module is carried to next positioning.
INC Linear 1
2 pulses
3 pulses ( = 2.5 + 0.5 )
Fixed-feed 1
2 pulses
2 pulses
0.5 pulses hold by the Simple Motion module is cleared to 0 at start and not carried to next positioning.

When the "reference axis speed" is set in 2- to 4-axis fixed-feed control, set so the major axis side becomes the reference axis. If the minor axis side is set as the reference axis, the major axis side speed may exceed the "[Pr.8] Speed limit value".

Refer to the following for the combination of the reference axis and the interpolation axis.

☞ Page 64 Interpolation control

# 2-axis circular interpolation control with sub point designation

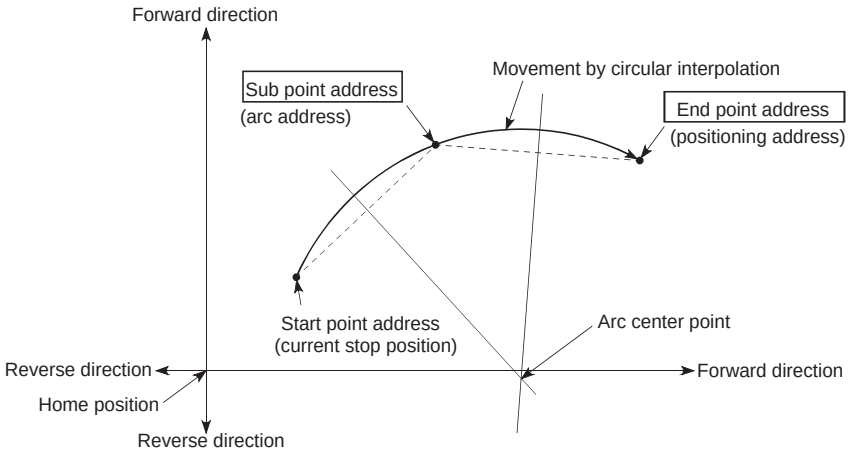
In "2-axis circular interpolation control" ("[Da.2] Control method" = ABS circular sub, INC circular sub), two motors are used to carry out position control in an arc path passing through designated sub points, while carrying out interpolation for the axis directions set in each axis. (Refer to ☞ Page 64 Interpolation control for details on interpolation control.)

## 2-axis circular interpolation control with sub point designation (ABS circular sub)

### ■Operation chart

In the absolute system, 2-axis circular interpolation control with sub point designation, positioning is carried out from the current stop position (start point address) to the address (end point address) set in "[Da.6] Positioning address/movement amount", in an arc path that passes through the sub point address set in "[Da.7] Arc address".

The resulting control path is an arc having as its center the intersection point of perpendicular bisectors of a straight line between the start point address (current stop position) and sub point address (arc address), and a straight line between the sub point address (arc address) and end point address (positioning address).




### ■Restrictions

2-axis circular interpolation control cannot be set in the following cases.

- When "degree" is set in "[Pr.1] Unit setting"
- When the units set in "[Pr.1] Unit setting" are different for the reference axis and interpolation axis. ("mm" and "inch" combinations are possible.)
- When "reference axis speed" is set in "[Pr.20] Interpolation speed designation method"

An error will occur and the positioning start will not be possible in the following cases. The machine will immediately stop if the error is detected during positioning control.

- When the radius exceeds "536870912 (= $2^{29}$)" (the maximum radius for which circular interpolation control is possible is "536870912 (= $2^{29}$)"): The error "Outside radius range" (error code: 1A32H) will occur at positioning start.
- When the center point address is outside the range of "-2147483648 (-$2^{31}$) to 2147483647 ($2^{31}$ - 1)": The error "Sub point setting error" (error code: 1A27H to 1A2AH) will occur at positioning start.
- When the start point address is the same as the end point address: The error "End point setting error" (error code: 1A2BH, 1A2CH) will occur.
- When the start point address is the same as the sub point address: The error "Sub point setting error" (error code: 1A27H to 1A2AH) will occur.
- When the end point address is the same as the sub point address: The error "Sub point setting error" (error code: 1A27H to 1A2AH) will occur.
- When the start point address, sub point address, and end point address are in a straight line: The error "Sub point setting error" (error code: 1A27H to 1A2AH) will occur.

## ■Setting positioning data

When using 2-axis circular interpolation control with sub point designation (ABS circular sub), set the following positioning data.

◎: Always set, ○: Set as required, △: Setting restricted, —: Setting not required

| Setting item | | Setting required/not required for the reference axis | Setting required/not required for the interpolation axis |
|---|---|---|---|
| [Da.1] | Operation pattern | ◎ | — |
| [Da.2] | Control method | ◎<br>(Set ABS circular sub.) | — |
| [Da.3] | Acceleration time No. | ○ | — |
| [Da.4] | Deceleration time No. | ○ | — |
| [Da.6] | Positioning address/movement amount | ◎ | ◎ |
| [Da.7] | Arc address | ◎ | ◎ |
| [Da.8] | Command speed | ◎ | — |
| [Da.9] | Dwell time/JUMP destination positioning data No. | ○ | — |
| [Da.10] | M code/Condition data No./Number of LOOP to LEND repetitions/ Number of pitches | ○ | — |
| [Da.20] | Axis to be interpolated No.1 | ◎ | — |
| [Da.21] | Axis to be interpolated No.2 | — | — |
| [Da.22] | Axis to be interpolated No.3 | — | — |
| [Da.27] | M code ON signal output timing | ○ | — |
| [Da.28] | ABS direction in degrees | ○ | — |
| [Da.29] | Interpolation speed designation method | △ | — |

*1 Refer to the following for information on the setting details.
☞ Page 445 Positioning Data

**Restriction**

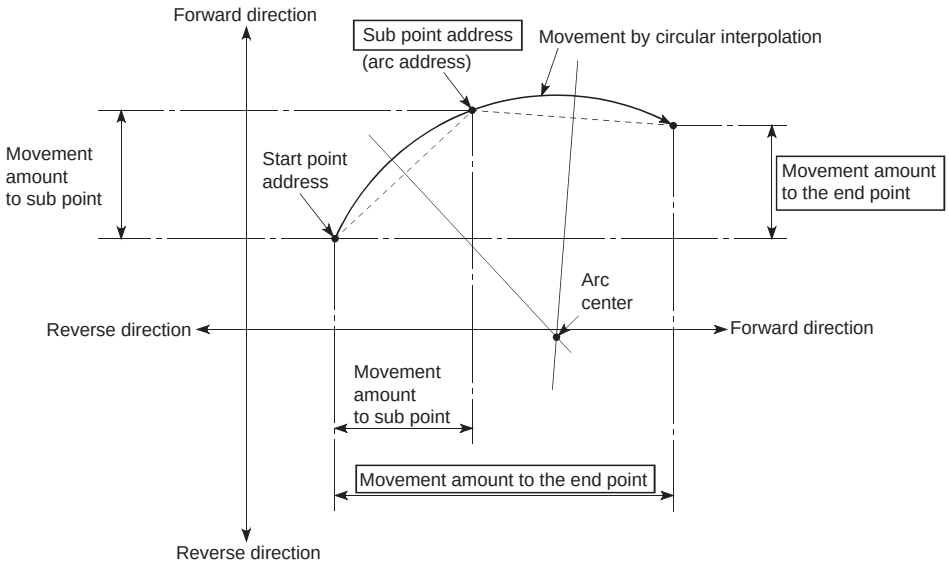
Set a value in "[Da.8] Command speed" so that the speed of each axis does not exceed the "[Pr.8] Speed limit value". (The speed limit does not function for the speed calculated by the Simple Motion module during interpolation control.)

## 2-axis circular interpolation control with sub point designation (INC circular sub)

### ■Operation chart

In the incremental system, 2-axis circular interpolation control with sub point designation, positioning is carried out from the current stop position (start point address) to a position at the end of the movement amount set in "[Da.6] Positioning address/ movement amount" in an arc path that passes through the sub point address set in "[Da.7] Arc address". The movement direction depends on the sign (+ or -) of the movement amount.

The resulting control path is an arc having as its center the intersection point of perpendicular bisectors of the straight line between the start point address (current stop position) and sub point address (arc address) calculated from the movement amount to the sub point, and a straight line between the sub point address (arc address) and end point address (positioning address) calculated from the movement amount to the end point.




### ■Restrictions

2-axis circular interpolation control cannot be set in the following cases.

- When "degree" is set in "[Pr.1] Unit setting"
- When the units set in "[Pr.1] Unit setting" are different for the reference axis and interpolation axis. ("mm" and "inch" combinations are possible.)
- When "reference axis speed" is set in "[Pr.20] Interpolation speed designation method"

An error will occur and the positioning start will not be possible in the following cases. The machine will immediately stop if the error is detected during positioning control.

- When the radius exceeds "536870912 (= $2^{29}$)" (the maximum radius for which circular interpolation control is possible is "536870912 (= $2^{29}$)"): The error "Outside radius range" (error code: 1A32H) will occur at positioning start.
- When the sub point address is outside the range of "-2147483648 (-$2^{31}$) to 2147483647 ($2^{31}$ - 1)": The error "Sub point setting error" (error code: 1A27H to 1A2AH) will occur.
- When the end point address is outside the range of "-2147483648 (-$2^{31}$) to 2147483647 ($2^{31}$ - 1)": The error "End point setting error" (error code: 1A2BH, 1A2CH) will occur.
- When the center point address is outside the range of "-2147483648 (-$2^{31}$) to 2147483647 ($2^{31}$ - 1)": The error "Sub point setting error" (error code: 1A27H to 1A2AH) will occur at positioning start.
- When the start point address is the same as the end point address: The error "End point setting error" (error code: 1A2BH, 1A2CH) will occur.
- When the start point address is the same as the sub point address: The error "Sub point setting error" (error code: 1A27H to 1A2AH) will occur.
- When the end point address is the same as the sub point address: The error "Sub point setting error" (error code: 1A27H to 1A2AH) will occur.
- When the start point address, sub point address, and end point address are in a straight line: The error "Sub point setting error" (error code: 1A27H to 1A2AH) will occur.

## ■Setting positioning data

When using 2-axis circular interpolation control with sub point designation (INC circular sub), set the following positioning data.

◎: Always set, ○: Set as required, △: Setting restricted, —: Setting not required

| Setting item | | Setting required/not required for the reference axis | Setting required/not required for the interpolation axis |
|---|---|---|---|
| [Da.1] | Operation pattern | ◎ | — |
| [Da.2] | Control method | ◎<br>(Set INC circular sub.) | — |
| [Da.3] | Acceleration time No. | ○ | — |
| [Da.4] | Deceleration time No. | ○ | — |
| [Da.6] | Positioning address/movement amount | ◎ | ◎ |
| [Da.7] | Arc address | ◎ | ◎ |
| [Da.8] | Command speed | ◎ | — |
| [Da.9] | Dwell time/JUMP destination positioning data No. | ○ | — |
| [Da.10] | M code/Condition data No./Number of LOOP to LEND repetitions/ Number of pitches | ○ | — |
| [Da.20] | Axis to be interpolated No.1 | ◎ | — |
| [Da.21] | Axis to be interpolated No.2 | — | — |
| [Da.22] | Axis to be interpolated No.3 | — | — |
| [Da.27] | M code ON signal output timing | ○ | — |
| [Da.28] | ABS direction in degrees | ○ | — |
| [Da.29] | Interpolation speed designation method | △ | — |

*1 Refer to the following for information on the setting details.
☞ Page 445 Positioning Data

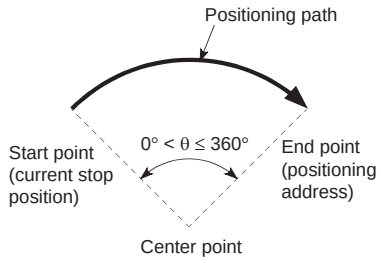
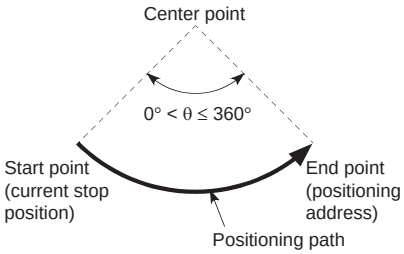
**Restriction**

Set a value in "[Da.8] Command speed" so that the speed of each axis does not exceed the "[Pr.8] Speed limit value". (The speed limit does not function for the speed calculated by the Simple Motion module during interpolation control.)

# 2-axis circular interpolation control with center point designation

In "2-axis circular interpolation control" ("[Da.2] Control method" = ABS circular right, INC circular right, ABS circular left, INC circular left), two motors are used to carry out position control in an arc path having an arc address as a center point, while carrying out interpolation for the axis directions set in each axis. (Refer to ☞ Page 64 Interpolation control for details on interpolation control.)

The following table shows the rotation directions, arc center angles that can be controlled, and positioning paths for the different control methods.

| Control method | Rotation direction | Arc center angle that can be controlled | Positioning path |
|---|---|---|---|
| ABS circular right | Clockwise | $0° < \theta \leq 360°$ |  |
| INC circular right | | | |
| ABS circular left | Counterclockwise | |  |
| INC circular left | | | |



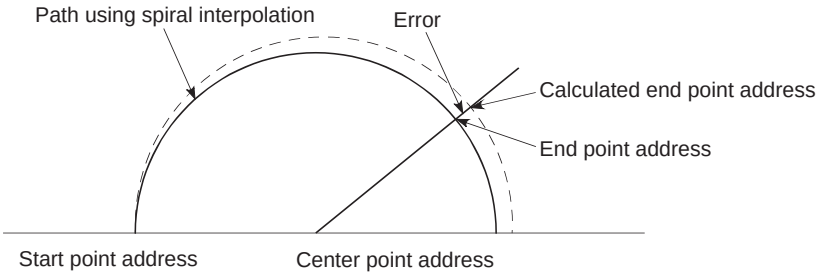


## Circular interpolation error compensation

In circular interpolation control with center point designation, the arc path calculated from the start point address and center point address may deviate from the position of the end point address set in "[Da.6] Positioning address/movement amount". (Refer to ☞ Page 430 [Pr.41] Allowable circular interpolation error width.)

### ■Calculated error ≤ "[Pr.41] Allowable circular interpolation error width"

Circular interpolation control to the set end point address is carried out while the error compensation is carried out. (This is called "spiral interpolation".)




In circular interpolation control with center point designation, an angular velocity is calculated on the assumption that operation is carried out at a command speed on the arc using the radius calculated from the start point address and center point address, and the radius is compensated in proportion to the angular velocity deviated from that at the start point. Thus, when there is a difference (error) between a radius calculated from the start point address and center point address (start point radius) and a radius calculated from the end point address and center point address (end point radius), the composite speed differs from the command speed as follows.

| | |
|---|---|
| Start point radius > End point radius | As compared with the speed without error, the speed becomes slower as end point address is reached. |
| Start point radius < End point radius | As compared with the speed without error, the speed becomes faster as end point address is reached. |

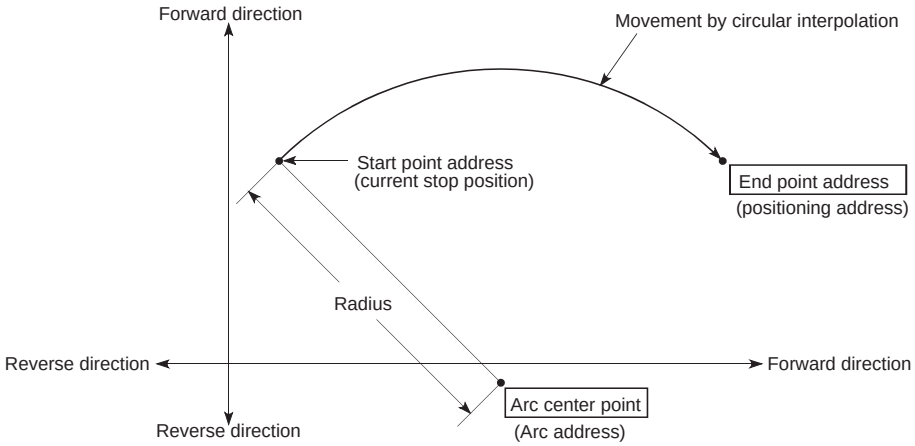
### ■Calculated error > "[Pr.41] Allowable circular interpolation error width"

At the positioning start, the error "Large arc error deviation" (error code: 1A17H) will occur and the control will not start. The machine will immediately stop if the error is detected during positioning control.

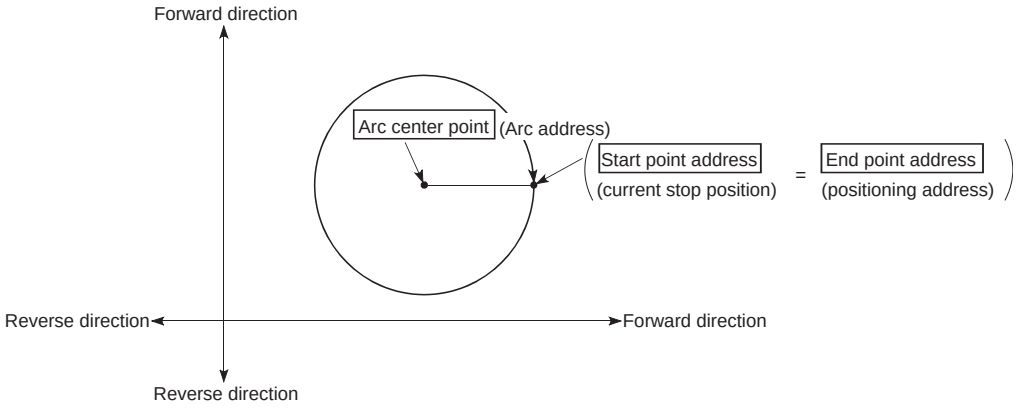
## 2-axis circular interpolation control with center point designation (ABS circular)

### ■Operation chart

In the absolute system, 2-axis circular interpolation control with center point designation positioning is carried out from the current stop position (start point address) to the address (end point address) set in "[Da.6] Positioning address/movement amount", in an arc path having as its center the address (arc address) of the center point set in "[Da.7] Arc address".




Positioning of a complete round with a radius from the start point address to the arc center point can be carried out by setting the end point address (positioning address) to the same address as the start point address.




In circular interpolation control with center point designation, an angular velocity is calculated on the assumption that operation is carried out at a command speed on the arc using the radius calculated from the start point address and center point address, and the radius is compensated in proportion to the angular velocity deviated from that at the start point. Thus, when there is a difference (error) between a radius calculated from the start point address and center point address (start point radius) and a radius calculated from the end point address and center point address (end point radius), the composite speed differs from the command speed as follows.

| | |
|---|---|
| Start point radius > End point radius | As compared with the speed without error, the speed becomes slower as end point address is reached. |
| Start point radius < End point radius | As compared with the speed without error, the speed becomes faster as end point address is reached. |

## ■Restrictions

2-axis circular interpolation control cannot be set in the following cases.

- When "degree" is set in "[Pr.1] Unit setting"
- When the units set in "[Pr.1] Unit setting" are different for the reference axis and interpolation axis. ("mm" and "inch" combinations are possible.)
- When "reference axis speed" is set in "[Pr.20] Interpolation speed designation method"

An error will occur and the positioning start will not be possible in the following cases. The machine will immediately stop if the error is detected during positioning control.

- When the radius exceeds "536870912 (= $2^{29}$)" (the maximum radius for which circular interpolation control is possible is "536870912 (= $2^{29}$)"): The error "Outside radius range" (error code: 1A32H) will occur at positioning start.
- When the start point address is the same as the center point address: The error "Center point setting error" (error code: 1A2DH to 1A2FH) will occur.
- When the end point address is the same as the center point address: The error "Center point setting error" (error code: 1A2DH to 1A2FH) will occur.
- When the center point address is outside the range of -2147483648 (-$2^{31}$) to 2147483647 ($2^{31}$ - 1): The error "Center point setting error" (error code: 1A2DH to 1A2FH) will occur.

## ■Setting positioning data

When using 2-axis circular interpolation control with center point designation (ABS circular right, ABS circular left), set the following positioning data.

◎: Always set, ○: Set as required, △: Setting restricted, —: Setting not required

| Setting item | | Setting required/not required for the reference axis | Setting required/not required for the interpolation axis |
|---|---|---|---|
| [Da.1] | Operation pattern | ◎ | — |
| [Da.2] | Control method | ◎<br>(Set ABS circular right or ABS circular left.) | — |
| [Da.3] | Acceleration time No. | ○ | — |
| [Da.4] | Deceleration time No. | ○ | — |
| [Da.6] | Positioning address/movement amount | ◎ | ◎ |
| [Da.7] | Arc address | ◎ | ◎ |
| [Da.8] | Command speed | ◎ | — |
| [Da.9] | Dwell time/JUMP destination positioning data No. | ○ | — |
| [Da.10] | M code/Condition data No./Number of LOOP to LEND repetitions/ Number of pitches | ○ | — |
| [Da.20] | Axis to be interpolated No.1 | ◎ | — |
| [Da.21] | Axis to be interpolated No.2 | — | — |
| [Da.22] | Axis to be interpolated No.3 | — | — |
| [Da.27] | M code ON signal output timing | ○ | — |
| [Da.28] | ABS direction in degrees | ○ | — |
| [Da.29] | Interpolation speed designation method | △ | — |

*1 Refer to the following for information on the setting details.
☞ Page 445 Positioning Data

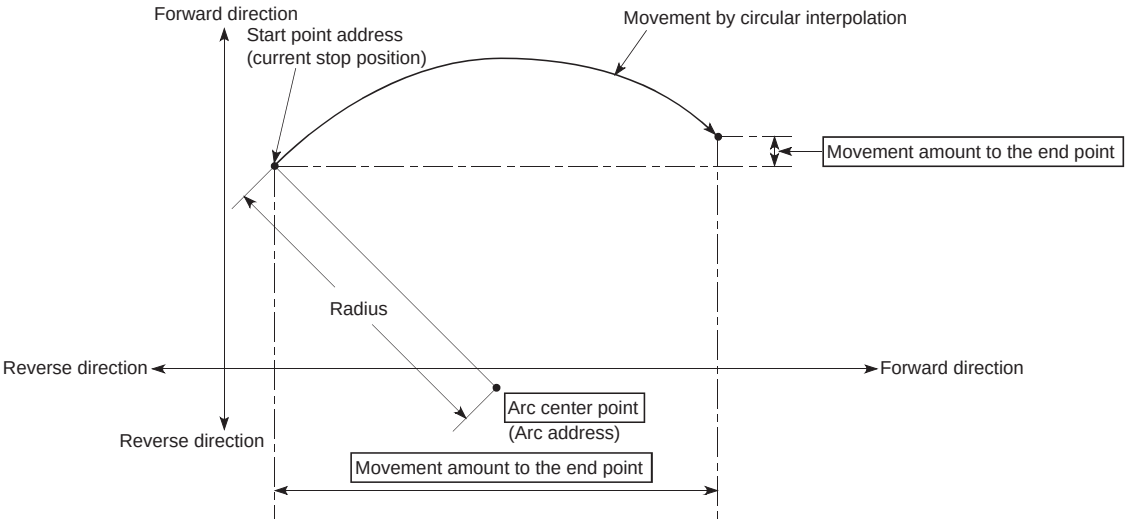
**Restriction**

Set a value in "[Da.8] Command speed" so that the speed of each axis does not exceed the "[Pr.8] Speed limit value". (The speed limit does not function for the speed calculated by the Simple Motion module during interpolation control.)

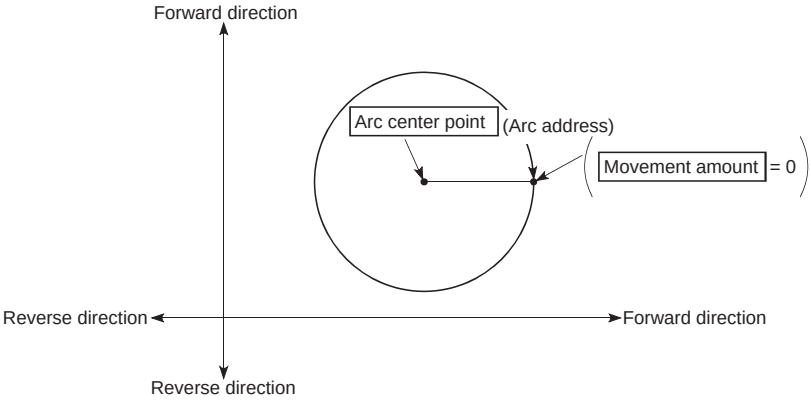
## 2-axis circular interpolation control with center point designation (INC circular)

### ■Operation chart

In the incremental system, 2-axis circular interpolation control with center point designation, positioning is carried out from the current stop position (start point address) to a position at the end of the movement amount set in "[Da.6] Positioning address/ movement amount", in an arc path having as its center the address (arc address) of the center point set in "[Da.7] Arc address".




Positioning of a complete round with a radius of the distance from the start point address to the arc center point can be carried out by setting the movement amount to "0".




In circular interpolation control with center point designation, an angular velocity is calculated on the assumption that operation is carried out at a command speed on the arc using the radius calculated from the start point address and center point address, and the radius is compensated in proportion to the angular velocity deviated from that at the start point. Thus, when there is a difference (error) between a radius calculated from the start point address and center point address (start point radius) and a radius calculated from the end point address and center point address (end point radius), the composite speed differs from the command speed as follows.

| | |
|---|---|
| Start point radius > End point radius | As compared with the speed without error, the speed becomes slower as end point address is reached. |
| Start point radius < End point radius | As compared with the speed without error, the speed becomes faster as end point address is reached. |

## ■Restrictions

2-axis circular interpolation control cannot be set in the following cases.

- When "degree" is set in "[Pr.1] Unit setting"
- When the units set in "[Pr.1] Unit setting" are different for the reference axis and interpolation axis. ("mm" and "inch" combinations are possible.)
- When "reference axis speed" is set in "[Pr.20] Interpolation speed designation method"

An error will occur and the positioning start will not be possible in the following cases. The machine will immediately stop if the error is detected during positioning control.

- When the radius exceeds "536870912 (= $2^{29}$)" (the maximum radius for which circular interpolation control is possible is "536870912 (= $2^{29}$)"): The error "Outside radius range" (error code: 1A32H) will occur at positioning start.
- When the end point address is outside the range of -2147483648 (-$2^{31}$) to 2147483647 ($2^{31}$ - 1): The error "End point setting error" (error code: 1A2BH, 1A2CH) will occur.
- When the start point address is the same as the center point address: The error "Center point setting error" (error code: 1A2DH to 1A2FH) will occur.
- When the end point address is the same as the center point address: The error "Center point setting error" (error code: 1A2DH to 1A2FH) will occur.
- When the center point address is outside the range of -2147483648 (-$2^{31}$) to 2147483647 ($2^{31}$ - 1): The error "Center point setting error" (error code: 1A2DH to 1A2FH) will occur.

## ■Setting positioning data

When using 2-axis circular interpolation control with center point designation (INC circular right, INC circular left), set the following positioning data.

◎: Always set, ○: Set as required, △: Setting restricted, —: Setting not required

| Setting item | | Setting required/not required for the reference axis | Setting required/not required for the interpolation axis |
|---|---|---|---|
| [Da.1] | Operation pattern | ◎ | — |
| [Da.2] | Control method | ◎<br>(Set INC circular right or INC circular left.) | — |
| [Da.3] | Acceleration time No. | ○ | — |
| [Da.4] | Deceleration time No. | ○ | — |
| [Da.6] | Positioning address/movement amount | ◎ | ◎ |
| [Da.7] | Arc address | ◎ | ◎ |
| [Da.8] | Command speed | ◎ | — |
| [Da.9] | Dwell time/JUMP destination positioning data No. | ○ | — |
| [Da.10] | M code/Condition data No./Number of LOOP to LEND repetitions/ Number of pitches | ○ | — |
| [Da.20] | Axis to be interpolated No.1 | ◎ | — |
| [Da.21] | Axis to be interpolated No.2 | — | — |
| [Da.22] | Axis to be interpolated No.3 | — | — |
| [Da.27] | M code ON signal output timing | ○ | — |
| [Da.28] | ABS direction in degrees | ○ | — |
| [Da.29] | Interpolation speed designation method | △ | — |

*1 Refer to the following for information on the setting details.
☞ Page 445 Positioning Data

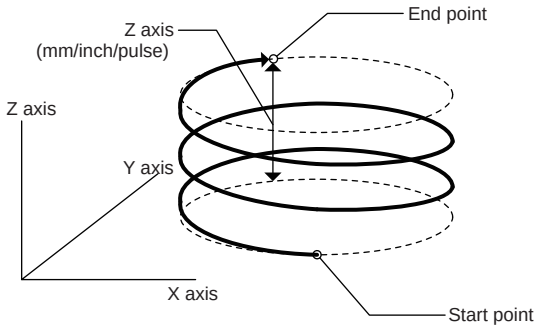
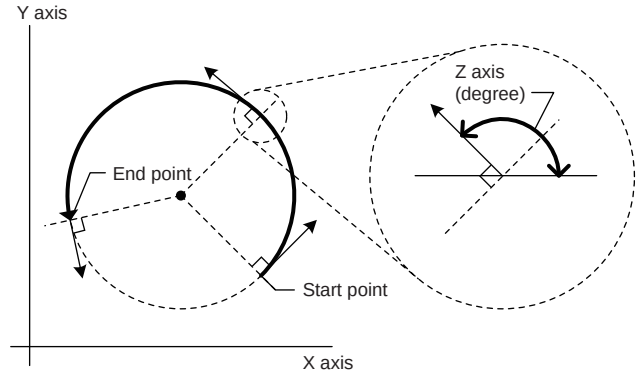
**Restriction**

Set a value in "[Da.8] Command speed" so that the speed of each axis does not exceed the "[Pr.8] Speed limit value". (The speed limit does not function for the speed calculated by the Simple Motion module during interpolation control.)

# 3-axis helical interpolation control with sub point designation

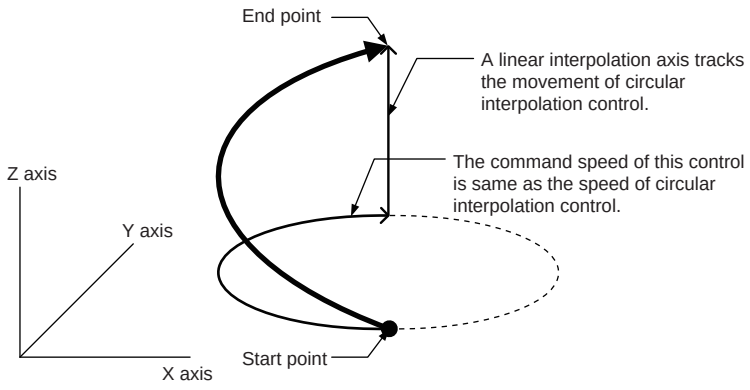
In "3-axis helical interpolation control" ("[Da.2] Control method" = ABS helical sub, INC helical sub), three motors are used to carry out the circular interpolation control of 2 axes. The remaining axis is used for "helical control" or "tangent control and normal line control".

X axis: Reference axis, Y axis: Circular interpolation axis, Z axis: Linear interpolation axis

| Control details | Control overview | Positioning path |
|---|---|---|
| Helical control |  | Draws a helical path by following the linear interpolation axis (linear control) to the circular interpolation control.<br>■Unit setting<br>• Reference axis: mm/inch, pulse<br>• Circular interpolation axis: The same as the reference axis<br>• Linear interpolation axis: mm/inch, pulse |
| Tangent control/ Normal line control |  | Keeps the direction of the workpiece against the center point of the circular interpolation control by following the value of the linear interpolation axis (degree) to the circular interpolation control. The figure shown on the left is an example in which the direction of the workpiece is kept to the direction of the tangent or normal line.<br>■Unit setting<br>• Reference axis: mm/inch, pulse<br>• Circular interpolation axis: The same as the reference axis<br>• Linear interpolation axis: degree |

## Speed of the helical interpolation control

The circular interpolation control (Reference axis—Composite speed of the circular interpolation axis) is the target of the command speed of the 3-axis helical interpolation control.

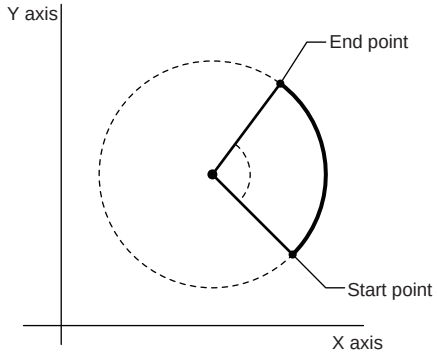

End point
A linear interpolation axis tracks the movement of circular interpolation control.
The command speed of this control is same as the speed of circular interpolation control.
Z axis
Y axis
X axis
Start point

**Point**

- When the movement amount of the linear interpolation axis is more than the composite movement amount of the circular interpolation axis, the speed of the linear interpolation axis cannot be suppressed with "[Pr.8] Speed limit value".
- When "0: Composite speed" is set in "[Pr.20] Interpolation speed designation method" or "1: Composite speed" is set in "[Da.29] Interpolation speed designation method", the command speed of ABS3/INC3 is the composite speed of the three axes (X axis—Y axis—Z axis). The command speed of the 3-axis helical interpolation control is the composite speed of the two axes (X axis—Y axis). When the continuous path control is performed using ABS3/INC3 and the 3-axis helical interpolation control, the movement speed of the workpiece may change at the positioning data switching; therefore, adjust the command speed not to shake the workpiece.

## Rotation angle of circular interpolation axis (X axis—Y axis)

The rotation angle of the circular interpolation axis in the 3-axis helical interpolation control is as follows.




| Number of pitch | Control of the circular interpolation axis |
|---|---|
| 0 | θ° |
| 1 | 360° + θ° |
| 2 | 720° + θ° |
| ⋮ | ⋮ |
| n | 360° × n + θ° |
| ⋮ | ⋮ |
| 999 | 360° × 999 + θ° |

**Restriction**

When "degree" is set to "[Pr.1] Unit setting", the positioning range of the absolute system is 0 to 359.99999°. If the rotation angle is 360° or larger in the circular interpolation axis (X axis—Y axis), the tangent control and normal line control cannot be performed because 360° or larger angle cannot be set for "[Da.6] Positioning address/movement amount" of the linear interpolation axis (Z axis: degree). To perform the tangent control or normal line control with the rotation of 360° or larger angle, use the incremental system.

## Rotation direction when the linear interpolation axis (Z axis) is set in degrees

When "degree" is set to "[Pr.1] Unit setting" for the linear interpolation axis, the rotation direction is determined depending on the axis control data in "[Cd.40] ABS direction in degrees" of the reference axis. To set a rotation direction for each positioning data, set "[Da.28] ABS direction in degrees" of each positioning data.

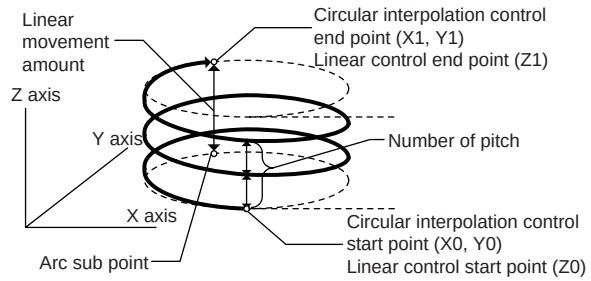
## 3-axis helical interpolation control with sub point designation (ABS helical sub)

### ■Operation chart

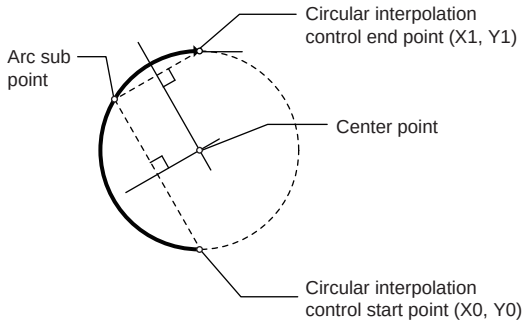
In the absolute system and 3-axis helical interpolation control with sub point designation, the positioning is performed from the current stop position (X0, Y0, Z0) to the position indicated with the arc end point address (X1 and Y1) and the linear interpolation axis end point address (Z1) set in "[Da.6] Positioning address/movement amount". As the positioning to the commanded position, the linear interpolation with the other linear interpolation axes is performed and the positioning target is rotated helically for the number of pitches set in "[Da.10] M code/Condition data No./Number of LOOP to LEND repetitions/ Number of pitches" of the linear interpolation axis while the circular interpolation through the sub point address (sub point address) set in "[Da.7] Arc address" is performed.

The resulting path is an arc whose center is the intersection point of the perpendicular bisectors of a straight line between the start point address (current stop position) and sub point address (arc address) and a straight line between the sub point address (arc address) and end point address (positioning address).

Operation chart




Top view of the circular interpolation


Arc sub point
Circular interpolation control end point (X1, Y1)
Center point
Circular interpolation control start point (X0, Y0)

### ■Restrictions

In the following cases, the 3-axis helical interpolation control cannot be set.

- When "degree" is set in "[Pr.1] Unit setting" of the reference axis and circular interpolation axis
- When the units set in "[Pr.1] Unit setting" are different between the reference axis and circular interpolation axis (The combination of "mm" and "inch" is possible.)
- When "reference axis speed" is set in "[Pr.20] Interpolation speed designation method"
- When the value out of the range of "0 to 999" is set in the number of pitches ("[Da.10] M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches")

In the following case, an error occurs and the positioning will not start. During the positioning control, the operation stops immediately at the detection of the error.

| Error cause | Error code |
|---|---|
| When the radius exceeds 536870912 (= $2^{29}$) (The maximum radius for which the circular interpolation control is possible is 536870912 (= $2^{29}$).) | The error "Outside radius range" (error code: 1A32H) occurs at the start of the positioning. |
| When the center point address is out of the range of -2147483648 (-$2^{31}$) to 2147483647 ($2^{31}$-1) | The error "Sub point setting error" (error code: 1A37H) occurs at the start of the positioning. |
| Start point address = End point address | The error "End point setting error" (error code: 1A2BH) |
| Start point address = Sub point address | The error "Sub point setting error" (error code: 1A27H) |
| End point address = Sub point address | The error "Sub point setting error" (error code: 1A28H) |
| When the start point address, sub point address, and end point address are on a straight line | The error "Sub point setting error" (error code: 1A29H) |

## ■Positioning data to be set

When using 3-axis helical interpolation control with sub point designation (ABS helical sub), set the following positioning data.

◎: Always set, ○: Set as required, △: Setting restricted, —: Setting not required

| Setting item | | Setting requirement of reference axis | Setting requirement of circular interpolation axis*1 | Setting requirement of linear interpolation axis*2 |
|---|---|---|---|---|
| [Da.1] | Operation pattern | ◎ | — | — |
| [Da.2] | Control method | ◎ (Set ABS helical sub.) | — | — |
| [Da.3] | Acceleration time No. | ◎ | — | — |
| [Da.4] | Deceleration time No. | ◎ | — | — |
| [Da.6] | Positioning address/movement amount | ◎ | ◎ | ◎ |
| [Da.7] | Arc address | ◎ | ◎ | — |
| [Da.8] | Command speed | ◎ | — | — |
| [Da.9] | Dwell time/JUMP destination positioning data No. | ○ | — | — |
| [Da.10] | M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches | ○ | — | ◎*3 |
| [Da.20] | Axis to be interpolated No.1 | ◎ | — | — |
| [Da.21] | Axis to be interpolated No.2 | ◎ | — | — |
| [Da.22] | Axis to be interpolated No.3 | — | — | — |
| [Da.27] | M code ON signal output timing | ○ | — | — |
| [Da.28] | ABS direction in degrees | ○ | — | — |
| [Da.29] | Interpolation speed designation method | △ | — | — |

*1 Specified in "[Da.20] Axis to be interpolated No.1" of the reference axis.
*2 Specified in "[Da.21] Axis to be interpolated No.2" of the reference axis.
*3 Set the number of pitches for the linear interpolation axis.
*4 Refer to the following for the setting details.
☞ Page 445 Positioning Data

**Restriction**

Set a value in "[Da.8] Command speed" so that the speed of each axis does not exceed the value in "[Pr.8] Speed limit value". (The speed limit does not function for the speed calculated by the Simple Motion module.)

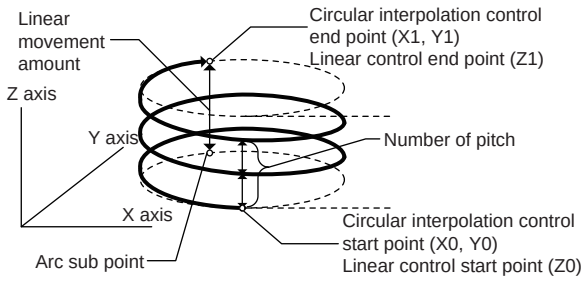
## 3-axis helical interpolation control with sub point designation (INC helical sub)

### ■Operation chart

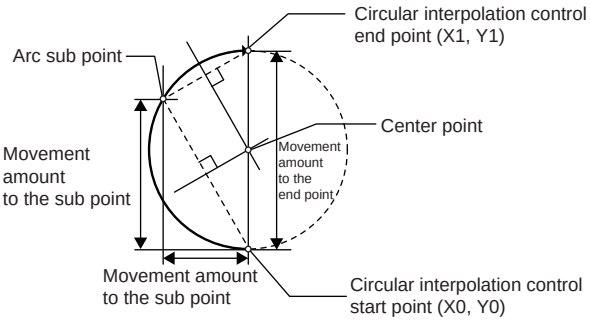
In the incremental system and 3-axis helical interpolation control with sub point designation, the positioning is performed from the current stop position (X0, Y0, Z0) to the position (X1, Y1, Z1) for the movement amount set in "[Da.6] Positioning address/ movement amount". As the positioning to the commanded position, the linear interpolation with the other linear interpolation axes is performed and the positioning target is rotated helically for the number of pitches set in "[Da.10] M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches" of the linear interpolation axis while the circular interpolation through the sub point address (sub point address) set in "[Da.7] Arc address" is performed. The movement direction is determined by the sign of the movement amount.

The resulting path is an arc whose center is the intersection point of the perpendicular bisectors of a straight line between the start point address (current stop position) and the sub point address (arc address) calculated from the movement amount to the sub point, and a straight line between the sub point address (arc address) and the end point address (positioning address) calculated from the movement amount to the end point.

Operation chart




Top view of the circular interpolation


Arc sub point
Movement amount to the sub point
Movement amount to the end point
Center point
Circular interpolation control end point (X1, Y1)
Movement amount to the sub point
Circular interpolation control start point (X0, Y0)

### ■Restrictions

In the following cases, the 3-axis helical interpolation control cannot be set.

- When "degree" is set in "[Pr.1] Unit setting" of the reference axis and circular interpolation axis
- When the units set in "[Pr.1] Unit setting" are different between the reference axis and circular interpolation axis (The combination of "mm" and "inch" is possible.)
- When "reference axis speed" is set in "[Pr.20] Interpolation speed designation method"
- When the value out of the range of "0 to 999" is set in the number of pitches ("[Da.10] M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches")

In the following case, an error occurs and the positioning will not start. During the positioning control, the operation stops immediately at the detection of the error.

| Error cause | Error code |
|---|---|
| When the radius exceeds 536870912 (= $2^{29}$) (The maximum radius for which the circular interpolation control is possible is 536870912 (= $2^{29}$).) | The error "Outside radius range" (error code: 1A32H) occurs at the start of the positioning. |
| When the sub point address is out of the range of -2147483648 (-$2^{31}$) to 2147483647 ($2^{31}$-1) | The error "Sub point setting error" (error code: 1A2AH) occurs at the start of the positioning. |
| When the end point address is out of the range of -2147483648 (-$2^{31}$) to 2147483647 ($2^{31}$-1) | The error "End point setting error" (error code: 1A2CH) occurs at the start of the positioning. |
| When the center point address is out of the range of -2147483648 (-$2^{31}$) to 2147483647 ($2^{31}$-1) | The error "Sub point setting error" (error code: 1A37H) occurs at the start of the positioning. |
| Start point address = End point address | The error "End point setting error" (error code: 1A2BH) |
| Start point address = Sub point address | The error "Sub point setting error" (error code: 1A27H) |
| End point address = Sub point address | The error "Sub point setting error" (error code: 1A28H) |
| When the start point address, sub point address, and end point address are on a straight line | The error "Sub point setting error" (error code: 1A29H) |

## ■Positioning data to be set

When using the 3-axis helical interpolation control with sub point designation (INC helical sub), set the following positioning data.

◎: Always set, ○: Set as required, △: Setting restricted, —: Setting not required

| Setting item | | Setting requirement of reference axis | Setting requirement of circular interpolation axis*1 | Setting requirement of linear interpolation axis*2 |
|---|---|---|---|---|
| [Da.1] | Operation pattern | ◎ | — | — |
| [Da.2] | Control method | ◎ (Set INC helical sub.) | — | — |
| [Da.3] | Acceleration time No. | ◎ | — | — |
| [Da.4] | Deceleration time No. | ◎ | — | — |
| [Da.6] | Positioning address/movement amount | ◎ | ◎ | ◎ |
| [Da.7] | Arc address | ◎ | ◎ | — |
| [Da.8] | Command speed | ◎ | — | — |
| [Da.9] | Dwell time/JUMP destination positioning data No. | ○ | — | — |
| [Da.10] | M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches | ○ | — | ◎*3 |
| [Da.20] | Axis to be interpolated No.1 | ◎ | — | — |
| [Da.21] | Axis to be interpolated No.2 | ◎ | — | — |
| [Da.22] | Axis to be interpolated No.3 | — | — | — |
| [Da.27] | M code ON signal output timing | ○ | — | — |
| [Da.28] | ABS direction in degrees | ○ | — | — |
| [Da.29] | Interpolation speed designation method | △ | — | — |

*1 Specified in "[Da.20] Axis to be interpolated No.1" of the reference axis.
*2 Specified in "[Da.21] Axis to be interpolated No.2" of the reference axis.
*3 Set the number of pitches for the linear interpolation axis.
*4 Refer to the following for the setting details.
☞ Page 445 Positioning Data

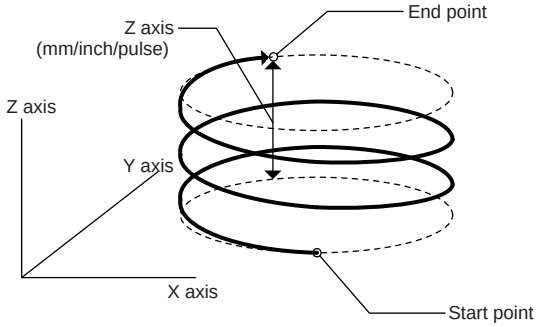
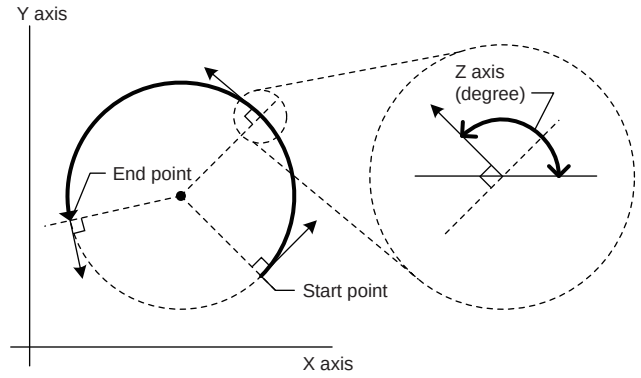
**Restriction**

Set a value in "[Da.8] Command speed" so that the speed of each axis does not exceed the value in "[Pr.8] Speed limit value". (The speed limit does not function for the speed calculated by the Simple Motion module.)

# 3-axis helical interpolation control with center point designation

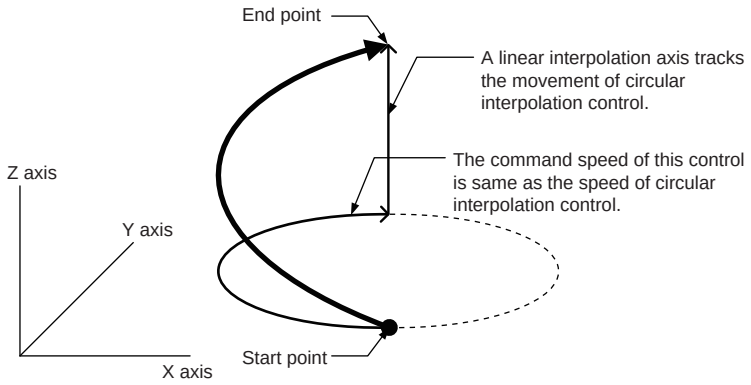
In "3-axis helical interpolation control" ("[Da.2] Control method" = ABS helical right, INC helical right, ABS helical left, INC helical left), three motors are used to carry out the circular interpolation control of 2 axes. The remaining axis is used for "helical control" or "tangent control and normal line control".

X axis: Reference axis, Y axis: Circular interpolation axis, Z axis: Linear interpolation axis

| Control details | Control overview | Positioning path |
|---|---|---|
| Helical control |  | Draws a helical path by following the linear interpolation axis (linear control) to the circular interpolation control.<br>■Unit setting<br>• Reference axis: mm/inch, pulse<br>• Circular interpolation axis: The same as the reference axis<br>• Linear interpolation axis: mm/inch, pulse |
| Tangent control/ Normal line control |  | Keeps the direction of the workpiece against the center point of the circular interpolation control by following the value of the linear interpolation axis (degree) to the circular interpolation control. The figure shown on the left is an example in which the direction of the workpiece is kept to the direction of the tangent or normal line.<br>■Unit setting<br>• Reference axis: mm/inch, pulse<br>• Circular interpolation axis: The same as the reference axis<br>• Linear interpolation axis: degree |

## Speed of the helical interpolation control

The circular interpolation control (Reference axis—Composite speed of the circular interpolation axis) is the target of the command speed of the 3-axis helical interpolation control.


End point
A linear interpolation axis tracks the movement of circular interpolation control.
The command speed of this control is same as the speed of circular interpolation control.
Z axis
Y axis
X axis
Start point

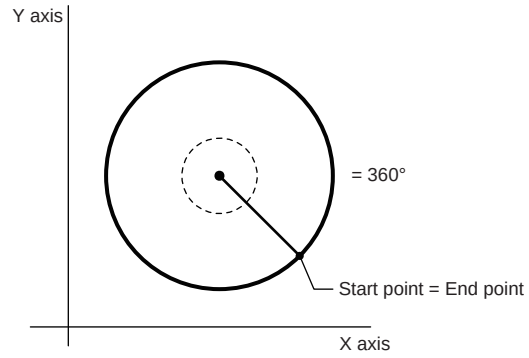
**Point**

- When the movement amount of the linear interpolation axis is more than the composite movement amount of the circular interpolation axis, the speed of the linear interpolation axis cannot be suppressed with "[Pr.8] Speed limit value".
- When "0: Composite speed" is set in "[Pr.20] Interpolation speed designation method" or "1: Composite speed" is set in "[Da.29] Interpolation speed designation method", the command speed of ABS3/INC3 is the composite speed of the three axes (X axis—Y axis—Z axis). The command speed of the 3-axis helical interpolation control is the composite speed of the two axes (X axis—Y axis). When the continuous path control is performed using ABS3/INC3 and the 3-axis helical interpolation control, the movement speed of the workpiece may change at the positioning data switching; therefore, adjust the command speed not to shake the workpiece.

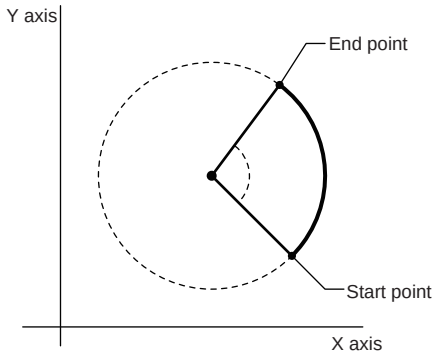
## Rotation angle of circular interpolation axis (X axis—Y axis)

The rotation angle of the circular interpolation axis in the 3-axis helical interpolation control is as follows.

True circle




Other than the true circle




| Number of pitch | Control of the circular interpolation axis | |
|---|---|---|
| | True circle | Other than the true circle |
| 0 | 360° | θ° |
| 1 | | 360° + θ° |
| 2 | 720° | 720° + θ° |
| ⋮ | ⋮ | ⋮ |
| n | 360° × n | 360° × n + θ° |
| ⋮ | ⋮ | ⋮ |
| 999 | 360° × 999 | 360° × 999 + θ° |

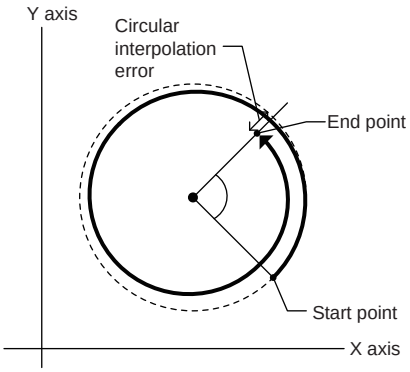
The setting of the true circle is available only when "Start point = End point" is set for the 3-axis helical interpolation (ABS/INC, center point).

**Restriction**

When "degree" is set to "[Pr.1] Unit setting", the positioning range of the absolute system is 0 to 359.99999°. If the rotation angle is 360° or larger in the circular interpolation axis (X axis—Y axis), the tangent control and normal line control cannot be performed because 360° or larger angle cannot be set for "[Da.6] Positioning address/movement amount" of the linear interpolation axis (Z axis: degree). To perform the tangent control or normal line control with the rotation of 360° or larger angle, use the incremental system.

## Error compensation of the circular interpolation axis

In the 3-axis helical interpolation control with center point designation, as well as the 2-axis circular interpolation control, "[Pr.41] Allowable circular interpolation error width" is enabled. When a circular interpolation error occurs, the path of the circular interpolation control (X axis—Y axis) becomes spiral as shown below.




## Rotation direction when the linear interpolation axis (Z axis) is set in degrees

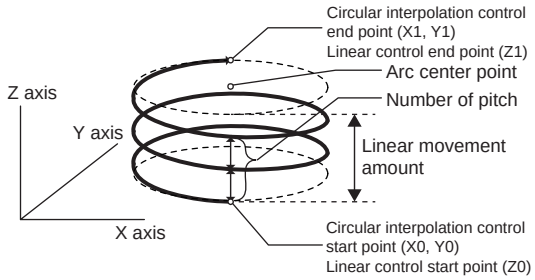
When "degree" is set to "[Pr.1] Unit setting" for the linear interpolation axis, the rotation direction is determined depending on the axis control data in "[Cd.40] ABS direction in degrees" of the reference axis. To set a rotation direction for each positioning data, set "[Da.28] ABS direction in degrees" of each positioning data.

## ABS helical right, ABS helical left

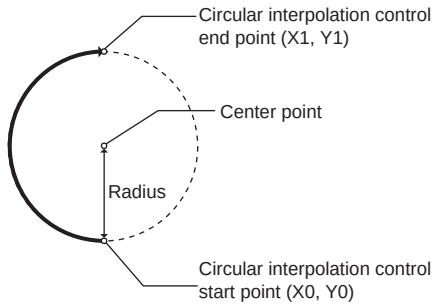
### ■Operation chart

In the absolute system and 3-axis helical interpolation control with center point designation, the positioning is performed from the current stop position (X0, Y0, Z0) to the position indicated with the arc end point address (X1 and Y1) and the linear interpolation axis end point address (Z1) set in "[Da.6] Positioning address/movement amount". As the positioning to the commanded position, the linear interpolation with the other linear interpolation axes is performed and the positioning target is rotated helically for the number of pitches set in "[Da.10] M code/Condition data No./Number of LOOP to LEND repetitions/ Number of pitches" of the linear interpolation axis while the circular interpolation of the circle whose center is the center point address (arc address) set in "[Da.7] Arc address" is performed.

Operation chart

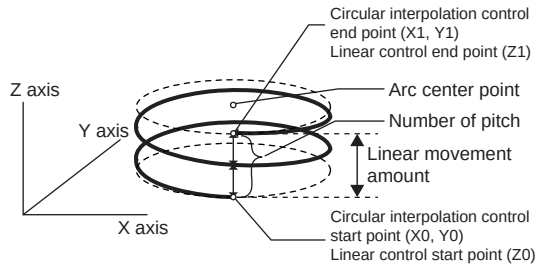



Top view of the circular interpolation

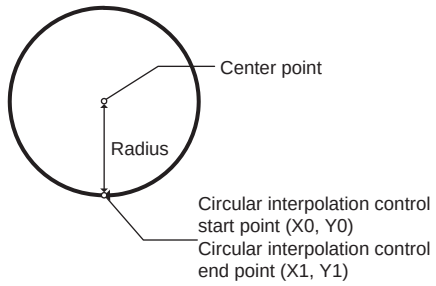



If the end point address (positioning address) of the circular interpolation axis is set to be the same as the start point address, the positioning of a true circle whose radius is from the start point address to the center point of the arc can be performed.

Operation chart




Top view of the circular interpolation




### ■Restrictions

In the following cases, the 3-axis helical interpolation control cannot be set.

- When "degree" is set in "[Pr.1] Unit setting" of the reference axis and circular interpolation axis
- When the units set in "[Pr.1] Unit setting" are different between the reference axis and circular interpolation axis (The combination of "mm" and "inch" is possible.)
- When "reference axis speed" is set in "[Pr.20] Interpolation speed designation method"
- When the value out of the range of "0 to 999" is set in the number of pitches ("[Da.10] M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches")

In the following case, an error occurs and the positioning will not start. During the positioning control, the operation stops immediately at the detection of the error.

| Error cause | Error code |
|---|---|
| When the radius exceeds 536870912 (= $2^{29}$) (The maximum radius for which the circular interpolation control is possible is 536870912 (= $2^{29}$).) | The error "Outside radius range" (error code: 1A32H) occurs at the start of the positioning. |
| Start point address = Center point address | The error "Center point setting error" (error code: 1A2DH) |
| End point address = Center point address | The error "Center point setting error" (error code: 1A2EH) |
| When the center point address is out of the range of -2147483648 (-$2^{31}$) to 2147483647 ($2^{31}$-1) | The error "Center point setting error" (error code: 1A2FH) |

## ■Positioning data to be set

When using the 3-axis helical interpolation control with center point designation (ABS helical right, ABS helical left), set the following positioning data.

◎: Always set, ○: Set as required, △: Setting restricted, —: Setting not required

| Setting item | | Setting requirement of reference axis | Setting requirement of circular interpolation axis*1 | Setting requirement of linear interpolation axis*2 |
|---|---|---|---|---|
| [Da.1] | Operation pattern | ◎ | — | — |
| [Da.2] | Control method | ◎ (Set ABS helical right or ABS helical left.) | — | — |
| [Da.3] | Acceleration time No. | ◎ | — | — |
| [Da.4] | Deceleration time No. | ◎ | — | — |
| [Da.6] | Positioning address/movement amount | ◎ | ◎ | ◎ |
| [Da.7] | Arc address | ◎ | ◎ | — |
| [Da.8] | Command speed | ◎ | — | — |
| [Da.9] | Dwell time/JUMP destination positioning data No. | ○ | — | — |
| [Da.10] | M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches | ○ | — | ◎*3 |
| [Da.20] | Axis to be interpolated No.1 | ◎ | — | — |
| [Da.21] | Axis to be interpolated No.2 | ◎ | — | — |
| [Da.22] | Axis to be interpolated No.3 | — | — | — |
| [Da.27] | M code ON signal output timing | ○ | — | — |
| [Da.28] | ABS direction in degrees | ○ | — | — |
| [Da.29] | Interpolation speed designation method | △ | — | — |

*1 Specified in "[Da.20] Axis to be interpolated No.1" of the reference axis.
*2 Specified in "[Da.21] Axis to be interpolated No.2" of the reference axis.
*3 Set the number of pitches for the linear interpolation axis.
*4 Refer to the following for the setting details.
☞ Page 445 Positioning Data

**Restriction**

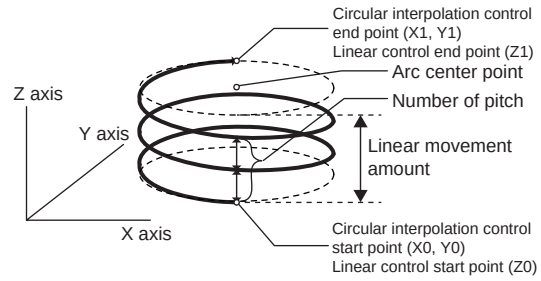
Set a value in "[Da.8] Command speed" so that the speed of each axis does not exceed the value in "[Pr.8] Speed limit value". (The speed limit does not function for the speed calculated by the Simple Motion module.)

## INC helical right, INC helical left

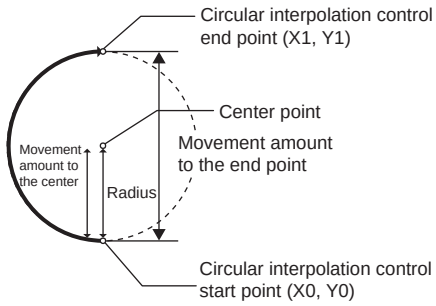
### ■Operation chart

In the incremental system and 3-axis helical interpolation control with center point designation, the positioning is performed from the current stop position (X0, Y0, Z0) to the position (X1, Y1, Z1) for the movement amount set in "[Da.6] Positioning address/movement amount". As the positioning to the commanded position, the linear interpolation with the other linear interpolation axes is performed and the positioning target is rotated helically for the number of pitches set in "[Da.10] M code/ Condition data No./Number of LOOP to LEND repetitions/Number of pitches" of the linear interpolation axis while the circular interpolation of the circle whose center is the center point address (arc address) set in "[Da.7] Arc address" is performed.

Operation chart

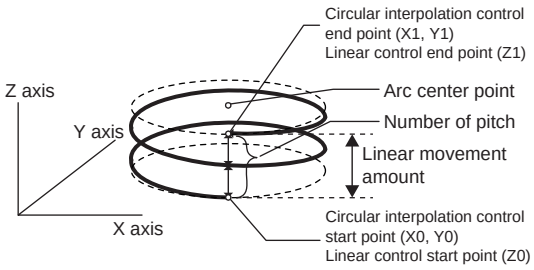



Top view of the circular interpolation

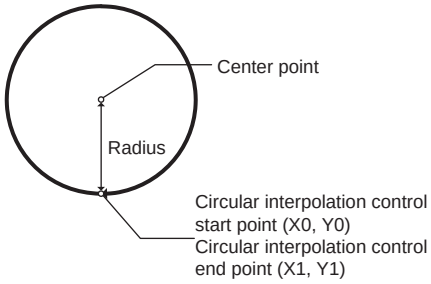



If "0" is set for the movement amount of the circular interpolation axis, the positioning of a true circle whose radius is from the start point address to the center point address of the arc can be performed.

Operation chart




Top view of the circular interpolation




### ■Restrictions

In the following cases, the 3-axis helical interpolation control cannot be set.

- When "degree" is set in "[Pr.1] Unit setting" of the reference axis and circular interpolation axis
- When the units set in "[Pr.1] Unit setting" are different between the reference axis and circular interpolation axis (The combination of "mm" and "inch" is possible.)
- When "reference axis speed" is set in "[Pr.20] Interpolation speed designation method"
- When the value out of the range of "0 to 999" is set in the number of pitches ("[Da.10] M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches")

In the following case, an error occurs and the positioning will not start. During the positioning control, the operation stops immediately at the detection of the error.

| Error cause | Error code |
|---|---|
| When the radius exceeds 536870912 (= $2^{29}$) (The maximum radius for which the circular interpolation control is possible is 536870912 (= $2^{29}$).) | The error "Outside radius range" (error code: 1A32H) occurs at the start of the positioning. |
| When the end point address is out of the range of -2147483648 (-$2^{31}$) to 2147483647 ($2^{31}$-1) | The error "End point setting error" (error code: 1A2CH) occurs at the start of the positioning. |
| Start point address = Center point address | The error "Center point setting error" (error code: 1A2DH) |
| End point address = Center point address | The error "Center point setting error" (error code: 1A2EH) |
| When the center point address is out of the range of -2147483648 (-$2^{31}$) to 2147483647 ($2^{31}$-1) | The error "Center point setting error" (error code: 1A2FH) |

## ■Positioning data to be set

When using the 3-axis helical interpolation control with center point designation (INC helical right, INC helical left), set the following positioning data.

◎: Always set, ○: Set as required, △: Setting restricted, —: Setting not required

| Setting item | | Setting requirement of reference axis | Setting requirement of circular interpolation axis*1 | Setting requirement of linear interpolation axis*2 |
|---|---|---|---|---|
| [Da.1] | Operation pattern | ◎ | — | — |
| [Da.2] | Control method | ◎ (Set INC helical right or INC helical left.) | — | — |
| [Da.3] | Acceleration time No. | ◎ | — | — |
| [Da.4] | Deceleration time No. | ◎ | — | — |
| [Da.6] | Positioning address/movement amount | ◎ | ◎ | ◎ |
| [Da.7] | Arc address | ◎ | ◎ | — |
| [Da.8] | Command speed | ◎ | — | — |
| [Da.9] | Dwell time/JUMP destination positioning data No. | ○ | — | — |
| [Da.10] | M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches | ○ | — | ◎*3 |
| [Da.20] | Axis to be interpolated No.1 | ◎ | — | — |
| [Da.21] | Axis to be interpolated No.2 | ◎ | — | — |
| [Da.22] | Axis to be interpolated No.3 | — | — | — |
| [Da.27] | M code ON signal output timing | ○ | — | — |
| [Da.28] | ABS direction in degrees | ○ | — | — |
| [Da.29] | Interpolation speed designation method | △ | — | — |

*1 Specified in "[Da.20] Axis to be interpolated No.1" of the reference axis.
*2 Specified in "[Da.21] Axis to be interpolated No.2" of the reference axis.
*3 Set the number of pitches for the linear interpolation axis.
*4 Refer to the following for the setting details.
☞ Page 445 Positioning Data

**Restriction**

Set a value in "[Da.8] Command speed" so that the speed of each axis does not exceed the value in "[Pr.8] Speed limit value". (The speed limit does not function for the speed calculated by the Simple Motion module.)

# Speed control

In "speed control" ("[Da.2] Control method" = Forward run: speed 1 to 4, Reverse run: speed 1 to 4), control is carried out in the axis direction in which the positioning data has been set by continuously outputting pulses for the speed set in "[Da.8] Command speed" until the input of a stop command.

The eight types of speed control includes "Forward run: speed 1 to 4" in which the control starts in the forward run direction, and "Reverse run: speed 1 to 4" in which the control starts in the reverse run direction.

Refer to the following for the combination of the reference axis and the interpolation axis.

☞ Page 64 Interpolation control

## Operation chart

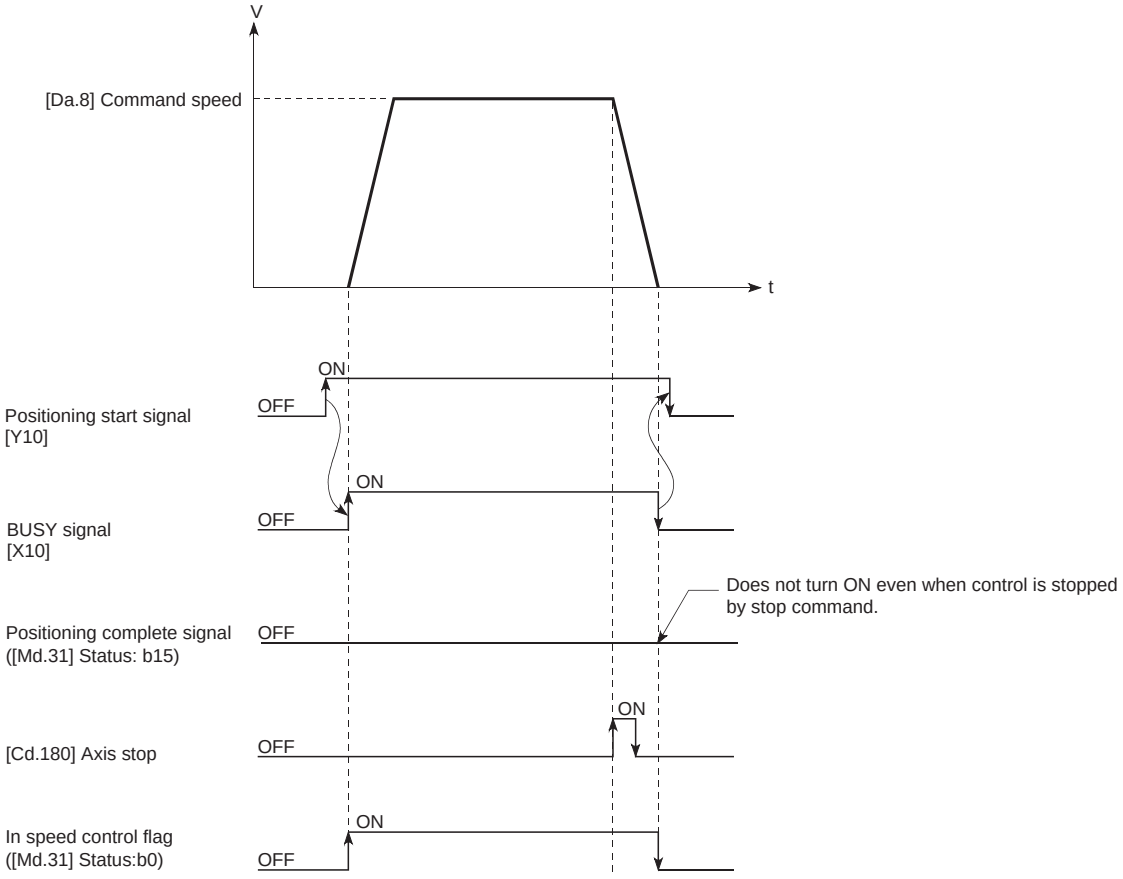
The following charts show the operation timing for 1-axis speed control with axis 1 and 2-axis speed control with axis 2 when the axis 1 is set as the reference axis.

The "in speed control" flag ([Md.31] Status: b0) is turned ON during speed control.

The "Positioning complete signal" is not turned ON.

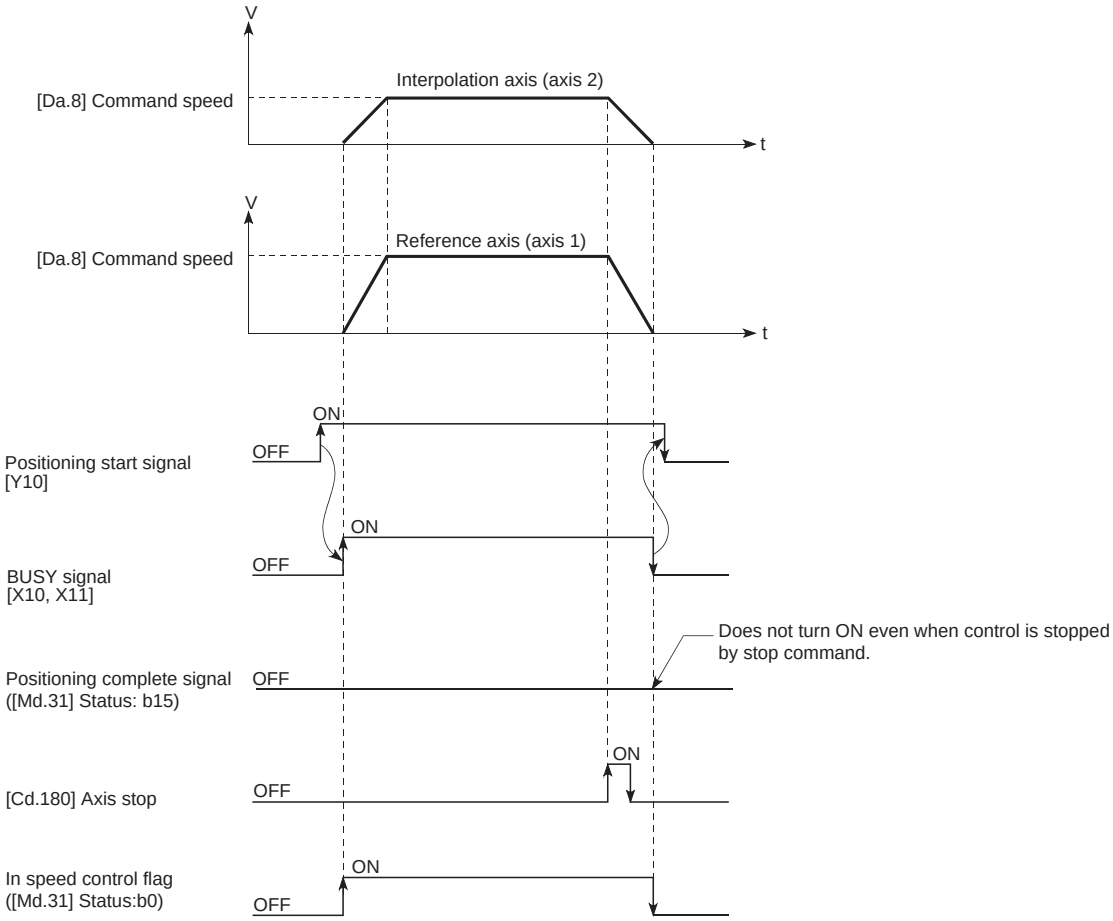
### ■1-axis speed control

RD77MS4 operation example



## ■2-axis speed control

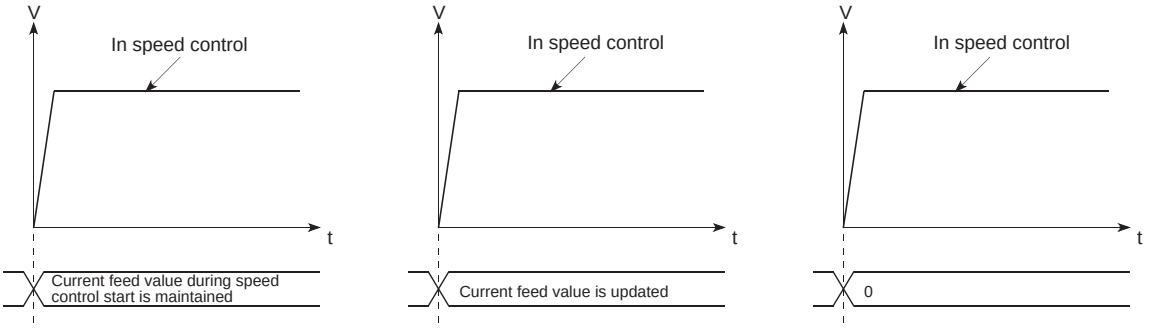
RD77MS4 operation example



## Current feed value

The following table shows the "[Md.20] Current feed value" during speed control corresponding to the "[Pr.21] Current feed value during speed control" settings. (However, the parameters use the set value of the reference axis.)

| "[Pr.21] Current feed value during speed control" setting | [Md.20] Current feed value |
|---|---|
| 0: Do not update current feed value | The current feed value at speed control start is maintained. |
| 1: Update current feed value | The current feed value is updated. |
| 2: Zero clear current feed value | The current feed value is fixed at 0. |




(a) Current feed value not updated (b) Current feed value updated (c) Current feed value zero cleared

## Restrictions

- Set "Positioning complete" in "[Da.1] Operation pattern". The error "Continuous path control not possible" (error code: 1A1EH to 1A20H) will occur and the operation cannot start if "continuous positioning control" or "continuous path control" is set in "[Da.1] Operation pattern". ("Continuous positioning control" and "continuous path control" cannot be set in speed control.)
- Set the WITH mode in the output timing when using an M code. The M code will not be output, and the M code ON signal will not turn ON if the AFTER mode is set.
- The error "No command speed" (error code: 1A12H to 1A14H) will occur if the current speed (-1) is set in "[Da.8] Command speed".
- Set "1: Reference axis speed" in "[Pr.20] Interpolation speed designation method". If "0: Composite speed" is set, the error "Interpolation mode error" (Error code: 199AH) occurs and the positioning will not start.
- The software stroke limit check is not carried out if the control unit is set to "degree".

### ■Restriction for the speed limit value

When either of control axes (1 to 4 axes) exceeds the speed limit, that axis is controlled with the speed limit value. The speeds of the other axes are limited at the ratios of "[Da.8] Command speed".

**Ex.**

When the axis 1 and the axis 2 are used

| Setting item | | Axis 1 setting | Axis 2 setting |
|---|---|---|---|
| [Pr.8] | Speed limit value | 4000.00 mm/min | 5000.00 mm/min |
| [Da.8] | Command speed | 8000.00 mm/min | 6000.00 mm/min |

With the settings shown above, the operation speed in speed control is as follows.

- Axis 1: 4000.00 mm/min (Speed is limited by [Pr.8].)
- Axis 2: 3000.00 mm/min (Speed is limited at a ratio of an axis 1 command speed to an axis 2 command speed.)

Operation runs at speed 1 when a reference axis speed is less than 1 as a result of speed limit. In addition, when the bias speed is set, the set value will be the minimum speed.

## Setting positioning data

When using speed control (forward run: speed 1 to 4, reverse run: speed 1 to 4), set the following positioning data.

◎: Always set, ○: Set as required, △: Setting restricted, —: Setting not required

| Setting item | | Setting required/not required for the reference axis | Setting required/not required for the interpolation axis |
|---|---|---|---|
| [Da.1] | Operation pattern | ◎ | — |
| [Da.2] | Control method | ◎ | — |
| [Da.3] | Acceleration time No. | ○ | — |
| [Da.4] | Deceleration time No. | ○ | — |
| [Da.6] | Positioning address/movement amount | — | — |
| [Da.7] | Arc address | — | — |
| [Da.8] | Command speed | ◎ | ◎ |
| [Da.9] | Dwell time/JUMP destination positioning data No. | ○ | — |
| [Da.10] | M code/Condition data No./Number of LOOP to LEND repetitions/ Number of pitches | ○ | — |
| [Da.20] | Axis to be interpolated No.1 | —*1 | — |
| [Da.21] | Axis to be interpolated No.2 | —*1 | — |
| [Da.22] | Axis to be interpolated No.3 | —*1 | — |
| [Da.27] | M code ON signal output timing | ○ | — |
| [Da.28] | ABS direction in degrees | ○ | — |
| [Da.29] | Interpolation speed designation method | △ | — |

*1 When using 2- to 4-axis speed control, it is necessary to set the axis to be used as the interpolation axis.

*2 Refer to the following for information on the setting details.

☞ Page 445 Positioning Data

# Speed-position switching control (INC mode)

In "speed-position switching control (INC mode)" ("[Da.2] Control method" = Forward run: speed/position, Reverse run: speed/position), the pulses of the speed set in "[Da.8] Command speed" are kept output on the axial direction set to the positioning data. When the "speed-position switching signal" is input, position control of the movement amount set in "[Da.6] Positioning address/movement amount" is exercised.

"Speed-position switching control (INC mode)" is available in two different types: "forward run: speed/position" which starts the axis in the forward run direction and "reverse run: speed/position" which starts the axis in the reverse run direction.

Use the detailed parameter 1 "[Pr.81] Speed-position function selection" with regard to the choice for "speed-position switching control (INC mode)".

n: Axis No. - 1

| Setting item | | Setting value | Setting details | Buffer memory address |
|---|---|---|---|---|
| [Pr.81] | Speed-position function selection | 0 | Speed-position switching control (INC mode) | 34+150n |

*1 If the set value is other than 0 and 2, it is regarded as 0 and operation is performed in the INC mode.
For details of the setting, refer to the following.
☞ Page 407 Basic Setting

## Switching over from speed control to position control

- The control is selected the switching method from speed control to position control by the setting value of "[Cd.45] Speed-position switching device selection".

n: Axis No. - 1

| Setting item | | Setting value | Setting details | Buffer memory address |
|---|---|---|---|---|
| [Cd.45] | Speed-position switching device selection | → | The device used for speed-position switching is selected.<br>0: Use the external command signal for switching from speed control to position control<br>1: Use the near-point signal for switching from speed control to position control<br>2: Use the "[Cd.46] Speed-position switching command" for switching from speed control to position control | 4366+100n |

The switching is performed by using the following device when "2" is set.

n: Axis No. - 1

| Setting item | | Setting value | Setting details | Buffer memory address |
|---|---|---|---|---|
| [Cd.46] | Speed-position switching command | → | The speed-position control switching is performed when "2" is set in "[Cd.45] Speed-position switching device selection". | 4367+100n |

- "[Cd.24] Speed-position switching enable flag" must be turned ON to switch over from speed control to position control. (If the "[Cd.24] Speed-position switching enable flag" turns ON after the speed-position switching signal turns ON, the control will continue as speed control without switching over to position control. The control will be switched over from position control to speed control when the speed-position switching signal turns from OFF to ON again. Only position control will be carried out when the "[Cd.24] Speed-position switching enable flag" and speed-position switching signal are ON at the operation start.)

n: Axis No. - 1

| Setting item | | Setting value | Setting details | Buffer memory address |
|---|---|---|---|---|
| [Cd.24] | Speed-position switching enable flag | 1 | 1: Speed control will be taken over by position control when the external command signal [DI] comes ON. | 4328+100n |

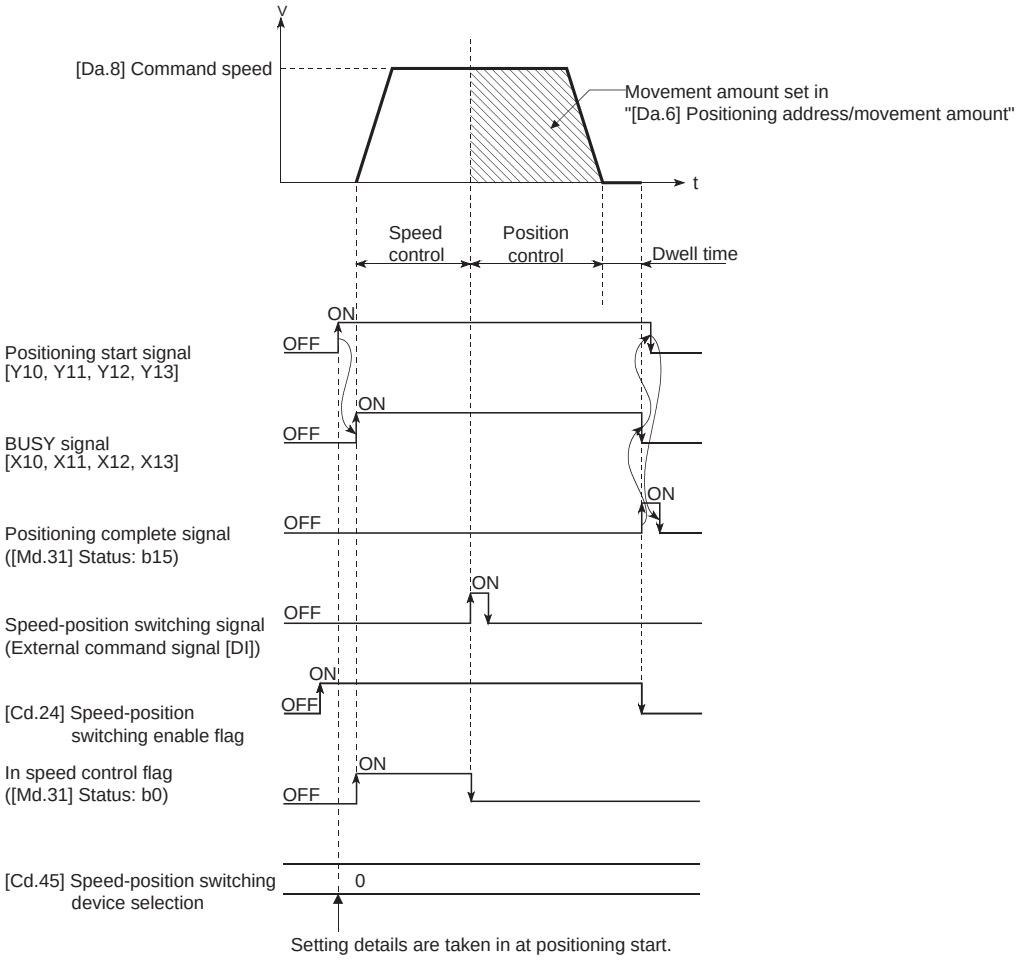
## Operation chart

The following chart shows the operation timing for speed-position switching control (INC mode).

The "in speed control flag" ([Md.31] Status: b0) is turned ON during speed control of speed-position switching control (INC mode).

### ■RD77MS4 operation example

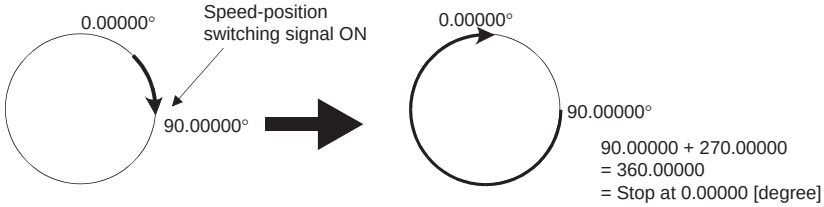
- When using the external command signal [DI] as speed-position switching signal




### ■Operation example

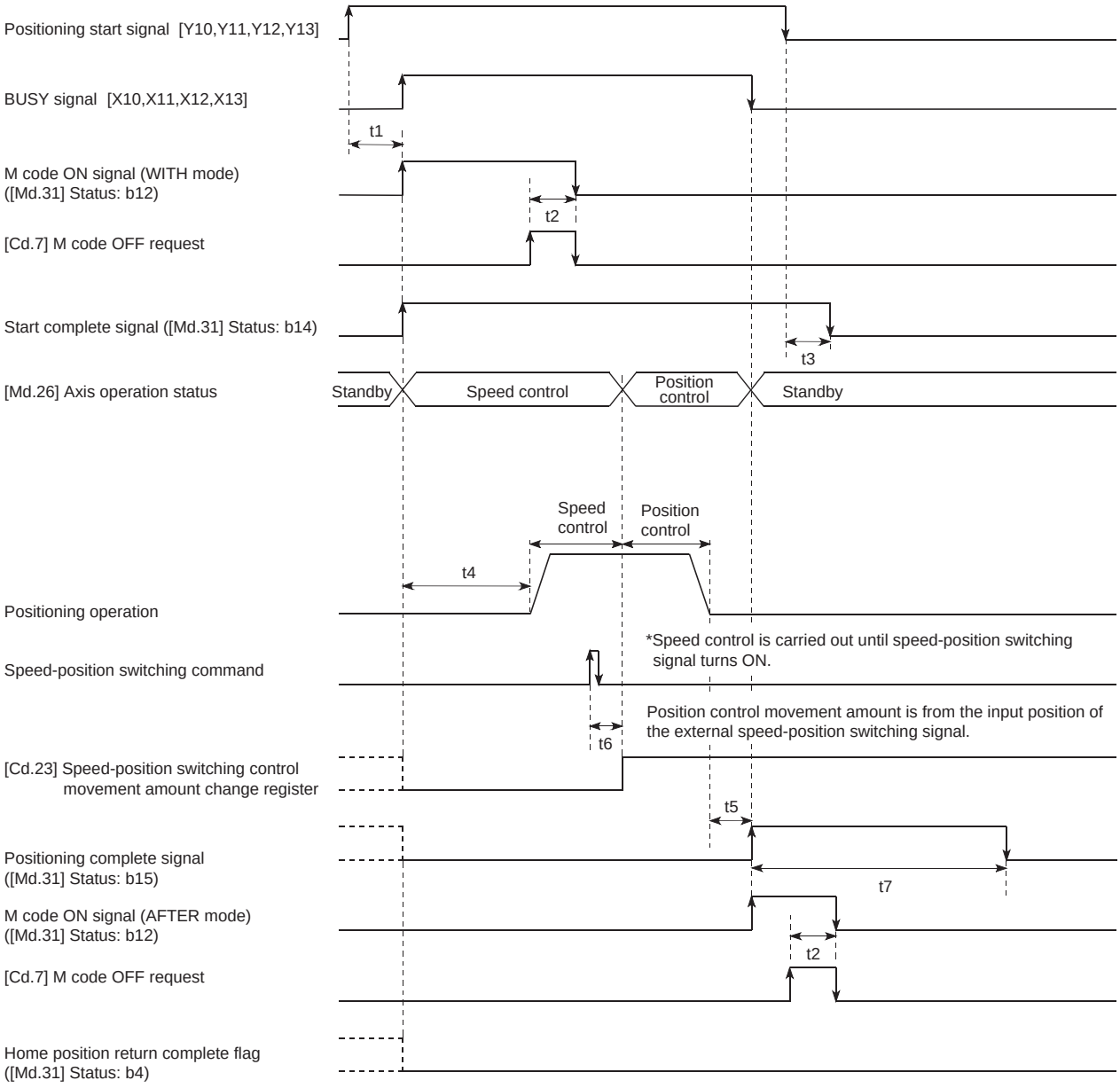
The following operation assumes that the speed-position switching signal is input at the position of the current feed value of 90.00000 [degree] during execution of "[Da.2] Control method" "Forward run: speed/position" at "[Pr.1] Unit setting" of "2: degree" and "[Pr.21] Current feed value during speed control" setting of "1: Update current feed value".

(The value set in "[Da.6] Positioning address/movement amount" is 270.00000 [degree])



## Operation timing and processing time

[RD77MS4 operation example]



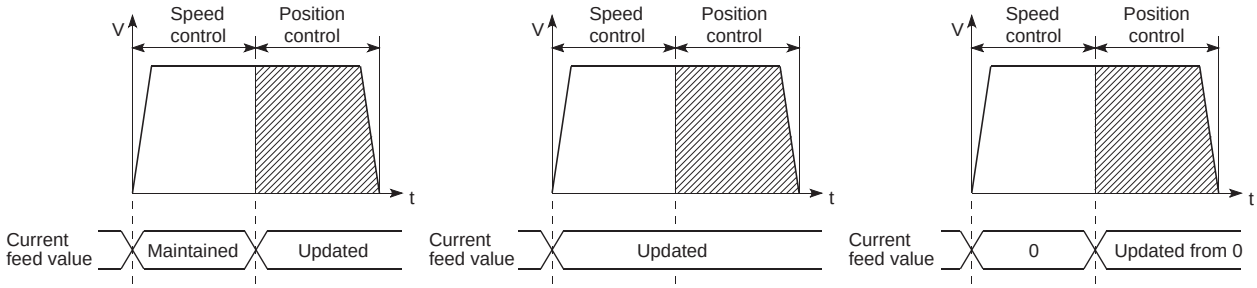

| Operation cycle | Normal timing time Unit: [ms] | | | | | | |
|---|---|---|---|---|---|---|---|
| | t1 | t2 | t3 | t4 | t5 | t6 | t7 |
| 0.444 | 0.316 to 1.366 | 0.000 to 0.444 | 0.000 to 0.444 | 0.503 to 1.599 | 0.000 to 0.444 | 0.346 | Follows parameters |
| 0.888 | 0.316 to 1.366 | 0.000 to 0.888 | 0.000 to 0.888 | 2.195 to 3.064 | 0.000 to 0.888 | 0.346 | Follows parameters |
| 1.777 | 0.316 to 1.366 | 0.000 to 1.777 | 0.000 to 1.777 | 3.798 to 4.459 | 0.000 to 1.777 | 0.348 | Follows parameters |
| 3.555 | 0.316 to 1.366 | 0.000 to 3.555 | 0.000 to 3.555 | 5.630 to 7.984 | 0.000 to 3.555 | 0.348 | Follows parameters |

- The t1 timing time could be delayed by the operation state of other axes.
- When using the near-point dog signal or "[Cd.46] Speed-position switching command", the t6 timing time could be delayed or vary influenced by the PLC scan time or communication with servo amplifier.

## Current feed value

The following table shows the "[Md.20] Current feed value" during speed-position switching control (INC mode) corresponding to the "[Pr.21] Current feed value during speed control" settings.

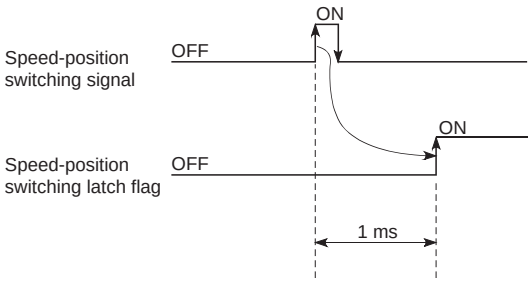
| "[Pr.21] Current feed value during speed control" setting | [Md.20] Current feed value |
|---|---|
| 0: Do not update current feed value | The current feed value at control start is maintained during speed control, and updated from the switching to position control. |
| 1: Update current feed value | The current feed value is updated during speed control and position control. |
| 2: Zero clear current feed value | The current feed value is cleared (set to "0") at control start, and updated from the switching to position control. |




(a) Current feed value not updated (b) Current feed value updated (c) Current feed value zero cleared

## Switching time from speed control to position control

It takes 1 ms from the time the speed-position switching signal is turned ON to the time the speed-position switching latch flag ([Md.31] Status: b1) turns ON.



## Speed-position switching signal setting

- The following table shows the items that must be set to use the external command signals [DI] as speed-position switching signals.

n: Axis No. - 1

| Setting item | | Setting value | Setting details | Buffer memory address |
|---|---|---|---|---|
| [Pr.42] | External command function selection | 2 | 2: Speed-position, position-speed switching request. | 62+150n |
| [Cd.8] | External command valid | 1 | 1: Validates an external command. | 4305+100n |
| [Cd.45] | Speed-position switching device selection | 0 | 0: Use the external command signal for switching from speed control to position control. | 4366+100n |

*1 Set the external command signal [DI] in "[Pr.95] External command signal selection". Refer to the followings for information on the setting details.
☞ Page 407 Basic Setting, Page 504 Control Data

- The following table shows the items that must be set to use the near-point dog signal (DOG) as speed-position switching signals.

n: Axis No. - 1

| Setting item | | Setting value | Setting details | Buffer memory address |
|---|---|---|---|---|
| [Cd.45] | Speed-position switching device selection | 1 | 1: Use the near-point dog signal for switching from speed control to position control | 4366+100n |

*2 The setting is not required for "[Pr.42] External command function selection" and "[Cd.8] External command valid". Refer to the following for information on the setting details.
☞ Page 504 Control Data

- The following table shows the items that must be set to use "[Cd.46] Speed-position switching command" as speed-position switching signals.

n: Axis No. - 1

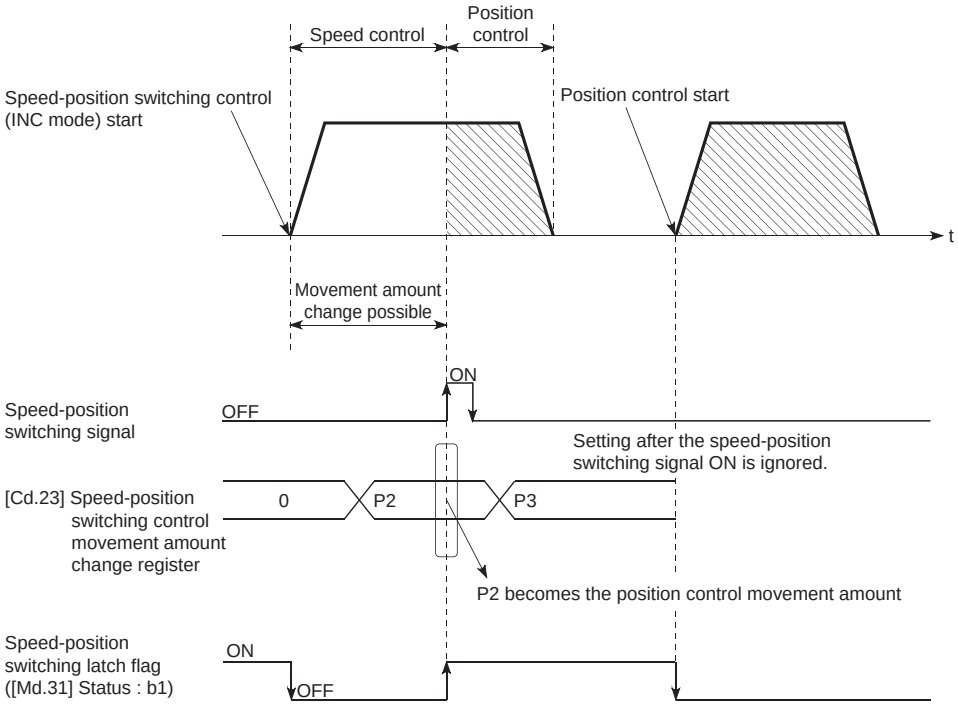
| Setting item | | Setting value | Setting details | Buffer memory address |
|---|---|---|---|---|
| [Cd.45] | Speed-position switching device selection | 2 | 2: Use the "[Cd.46] Speed-position switching command" for switching from speed control to position control | 4366+100n |

*3 The setting is not required for "[Pr.42] External command function selection" and "[Cd.8] External command valid". Refer to the following for information on the setting details.
☞ Page 504 Control Data

## Changing the position control movement amount

In "speed-position switching control (INC mode)", the position control movement amount can be changed during the speed control section.

- The position control movement amount can be changed during the speed control section of speed-position switching control (INC mode). A movement amount change request will be ignored unless issued during the speed control section of the speed-position switching control (INC mode).
- The "new movement amount" is stored in "[Cd.23] Speed-position switching control movement amount change register" by the program during speed control. When the speed-position switching signal is turned ON, the movement amount for position control is stored in "[Cd.23] Speed-position switching control movement amount change register".
- The movement amount is stored in the "[Md.29] Speed-position switching control positioning movement amount" of the axis monitor area from the point where the control changes to position control by the input of a speed-position switching signal from an external device.




**Point**

- The machine recognizes the presence of a movement amount change request when the data is written to "[Cd.23] Speed-position switching control movement amount change register" with the program.
- The new movement amount is validated after execution of the speed-position switching control (INC mode), before the input of the speed-position switching signal.
- The movement amount change can be enable/disable with the interlock function in position control using the "speed-position switching latch flag" ([Md.31] Status: b1) of the axis monitor area.

## Restrictions

- The error "Continuous path control not possible" (error code: 1A1EH to 1A20H) will occur and the operation cannot start if "continuous positioning control" or "continuous path control" is set in "[Da.1] Operation pattern".
- "Speed-position switching control" cannot be set in "[Da.2] Control method" of the positioning data when "continuous path control" has been set in "[Da.1] Operation pattern" of the immediately prior positioning data. (For example, if the operation pattern of positioning data No. 1 is "continuous path control", "speed-position switching control" cannot be set in positioning data No. 2.) The error "Continuous path control not possible" (error code: 1A1EH to 1A20H) will occur and the machine will carry out a deceleration stop if this type of setting is carried out.
- The error "No command speed" (error code: 1A12H to 1A14H) will occur if "current speed (-1)" is set in "[Da.8] Command speed".
- The software stroke limit range check during speed control is made only when the followings are satisfied:

| | |
|---|---|
| "[Pr.21] Current feed value during speed control" is "1: Update current feed value". | If the movement amount exceeds the software stroke limit range during speed control in case of the setting of other than "1: Update current feed value", the error "Software stroke limit +" (error code: 1993H) or "Software stroke limit -" (error code: 1995H) will occur as soon as speed control is changed to position control and the axis will decelerate to a stop. |
| When "[Pr.1] Unit setting" is other than "2: degree" | If the unit is "degree", the software stroke limit range check is not performed. |

- If the value set in "[Da.6] Positioning address/movement amount" is negative, the error "Outside address range" (error code: 1A30H, 1A31H) will occur.
- Deceleration processing is carried out from the point where the speed-position switching signal is input if the position control movement amount set in "[Da.6] Positioning address/movement amount" is smaller than the deceleration distance from the "[Da.8] Command speed".
- Turn ON the speed-position switching signal in the speed stabilization region (constant speed status). The warning "Speed-position switching (during acceleration) signal ON" (warning code: 0993H) will occur because of large deviation in the droop pulse amount if the signal is turned ON during acceleration. During use of the servo motor, the movement amount is "[Da.6] Positioning address/movement amount" from the assumed motor position based on "[Md.101] Real current value" at switching of speed control to position control. Therefore, if the signal is turned ON during acceleration/deceleration, the stop position will vary due to large variation of the droop pulse amount. Even though "[Md.29] Speed-position switching control positioning movement amount" is the same, the stop position will change due to a change in droop pulse amount when "[Da.8] Command speed" is different.

## Setting positioning data

When using speed-position switching control (INC mode), set the following positioning data.

◎: Always set, ○: Set as required, —: Setting not required

| Setting item | | Setting required/not required |
|---|---|---|
| [Da.1] | Operation pattern | ◎ |
| [Da.2] | Control method | ◎ (Set "Forward run: speed/position" or "Reverse run: speed/position".) |
| [Da.3] | Acceleration time No. | ○ |
| [Da.4] | Deceleration time No. | ○ |
| [Da.6] | Positioning address/movement amount | ◎ |
| [Da.7] | Arc address | — |
| [Da.8] | Command speed | ◎ |
| [Da.9] | Dwell time/JUMP destination positioning data No. | ○ |
| [Da.10] | M code/Condition data No./Number of LOOP to LEND repetitions/ Number of pitches | ○ |
| [Da.20] | Axis to be interpolated No.1 | — |
| [Da.21] | Axis to be interpolated No.2 | — |
| [Da.22] | Axis to be interpolated No.3 | — |
| [Da.27] | M code ON signal output timing | ○ |
| [Da.28] | ABS direction in degrees | — |
| [Da.29] | Interpolation speed designation method | — |

*1 Refer to the following for information on the setting details.
☞ Page 445 Positioning Data

# Speed-position switching control (ABS mode)

In case of "speed-position switching control (ABS mode)" ("[Da.2] Control method" = Forward run: speed/position, Reverse run: speed/position), the pulses of the speed set in "[Da.8] Command speed" are kept output in the axial direction set to the positioning data. When the "speed-position switching signal" is input, position control to the address set in "[Da.6] Positioning address/movement amount" is exercised.

"Speed-position switching control (ABS mode)" is available in two different types: "forward run: speed/position" which starts the axis in the forward run direction and "reverse run: speed/position" which starts the axis in the reverse run direction.

"Speed-position switching control (ABS mode)" is valid only when "[Pr.1] Unit setting" is "2: degree".

○: Setting allowed, ×: Setting disallowed (If setting is made, the error "Speed-position function selection error" (error code: 1AAEH) will occur when the PLC READY signal [Y0] turns ON.)

| Speed-position function selection | [Pr.1] Unit setting | | | |
|---|---|---|---|---|
| | mm | inch | degree | pulse |
| INC mode | ○ | ○ | ○ | ○ |
| ABS mode | × | × | ○ | × |

Use the detailed parameter 1 "[Pr.81] Speed-position function selection" to choose "speed-position switching control (ABS mode)".

n: Axis No. - 1

| Setting item | | Setting value | Setting details | Buffer memory address |
|---|---|---|---|---|
| [Pr.81] | Speed-position function selection | 2 | Speed-position switching control (ABS mode) | 34+150n |

*1 If the set value is other than 0 and 2, it is regarded as 0 and operation is performed in the INC mode. For details of the setting, refer to the following.

☞ Page 407 Basic Setting

## Switching over from speed control to position control

- The control is selected the switching method from speed control to position control by the setting value of "[Cd.45] Speed-position switching device selection".

n: Axis No. - 1

| Setting item | | Setting value | Setting details | Buffer memory address |
|---|---|---|---|---|
| [Cd.45] | Speed-position switching device selection | → | The device used for speed-position switching is selected.<br>0: Use the external command signal for switching from position control to speed control<br>1: Use the near-point signal for switching from position control to speed control<br>2: Use the "[Cd.46] Speed-position switching command" for switching from position control to speed control | 4366+100n |

The switching is performed by using the following device when "2" is set.

n: Axis No. - 1

| Setting item | | Setting value | Setting details | Buffer memory address |
|---|---|---|---|---|
| [Cd.46] | Speed-position switching command | → | The speed-position control switching is performed when "2" is set in "[Cd.45] Speed-position switching device selection". | 4367+100n |

- "[Cd.24] Speed-position switching enable flag" must be turned ON to switch over from speed control to position control. (If the "[Cd.24] Speed-position switching enable flag" turns ON after the speed-position switching signal turns ON, the control will continue as speed control without switching over to position control. The control will be switched over from speed control to position control when the speed-position switching signal turns from OFF to ON again. Only position control will be carried out when the "[Cd.24] Speed-position switching enable flag" and speed-position switching signal are ON at the operation start.)

n: Axis No. - 1

| Setting item | | Setting value | Setting details | Buffer memory address |
|---|---|---|---|---|
| [Cd.24] | Speed-position switching enable flag | 1 | 1: Speed control will be taken over by position control when the external command signal [DI] comes ON. | 4328+100n |

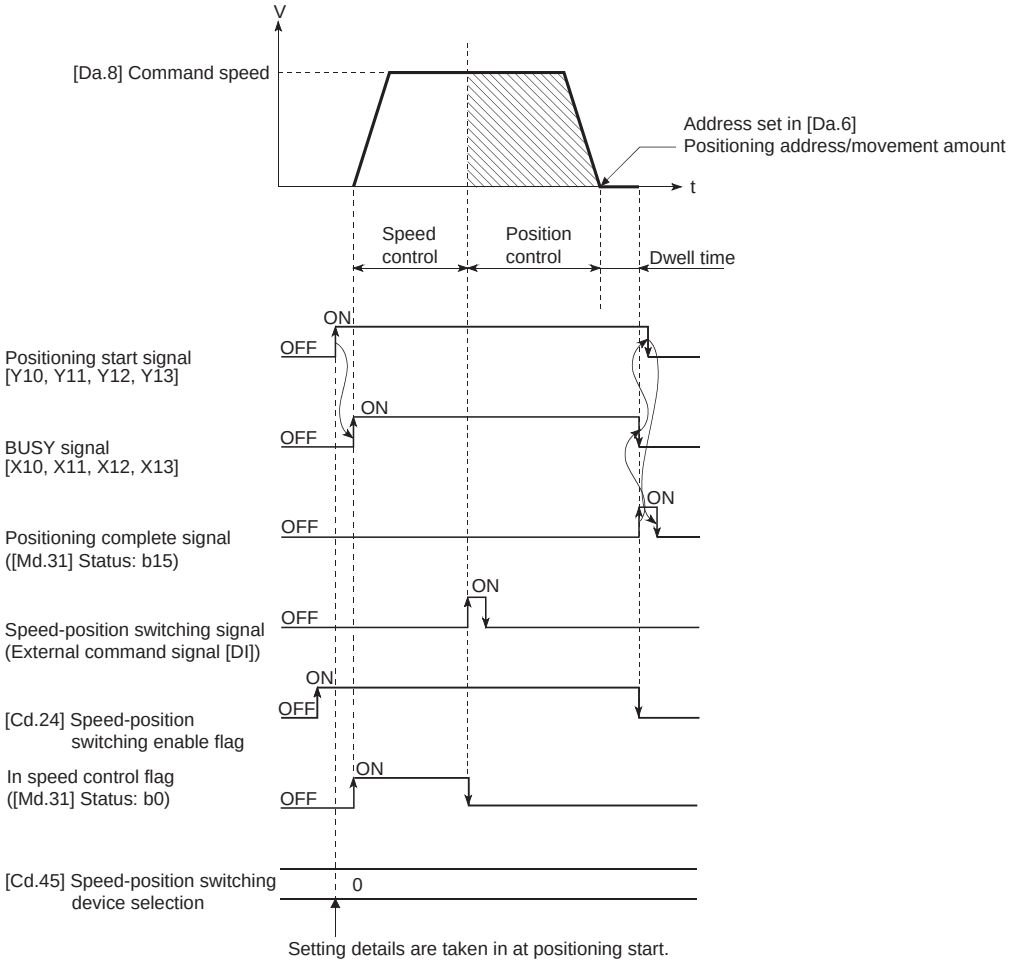
## Operation chart

The following chart shows the operation timing for speed-position switching control (ABS mode).

The "in speed control flag" ([Md.31] Status: b0) is turned ON during speed control of speed-position switching control (ABS mode).

### ■RD77MS4 operation example

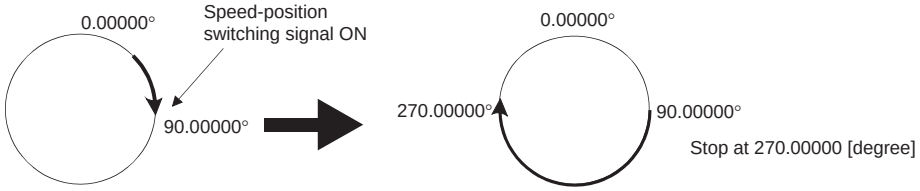
- When using the external command signal [DI] as speed-position switching signal




### ■Operation example

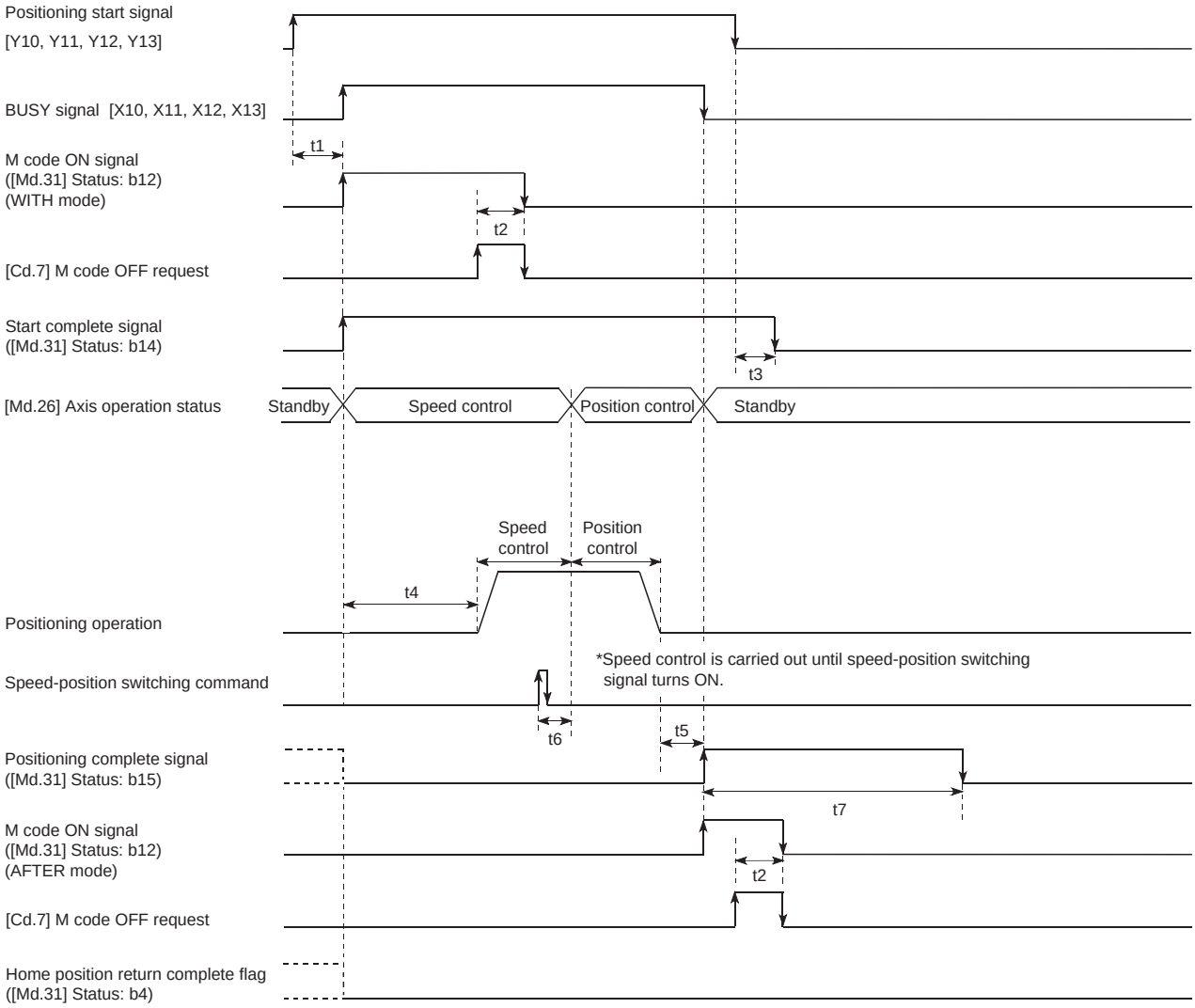
The following operation assumes that the speed-position switching signal is input at the position of the current feed value of 90.00000 [degree] during execution of "[Da.2] Control method" "Forward run: speed/position" at "[Pr.1] Unit setting" of "2: degree" and "[Pr.21] Current feed value during speed control" setting of "1: Update current feed value".

(The value set in "[Da.6] Positioning address/movement amount" is 270.00000 [degree])



## Operation timing and processing time

### ■RD77MS4 operation example




| Operation cycle | Normal timing time Unit: [ms] | | | | | | |
|---|---|---|---|---|---|---|---|
| | t1 | t2 | t3 | t4 | t5 | t6 | t7 |
| 0.444 | 0.316 to 1.366 | 0.000 to 0.444 | 0.000 to 0.444 | 0.503 to 1.599 | 0.000 to 0.444 | 0.346 | Follows parameters |
| 0.888 | 0.316 to 1.366 | 0.000 to 0.888 | 0.000 to 0.888 | 2.195 to 3.064 | 0.000 to 0.888 | 0.346 | Follows parameters |
| 1.777 | 0.316 to 1.366 | 0.000 to 1.777 | 0.000 to 1.777 | 3.798 to 4.459 | 0.000 to 1.777 | 0.348 | Follows parameters |
| 3.555 | 0.316 to 1.366 | 0.000 to 3.555 | 0.000 to 3.555 | 5.630 to 7.984 | 0.000 to 3.555 | 0.348 | Follows parameters |

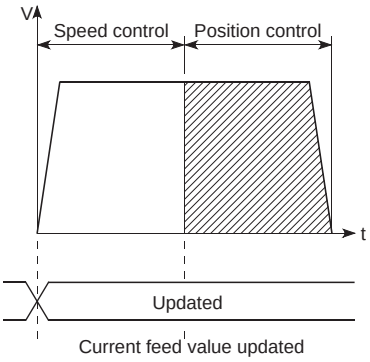
- The t1 timing time could be delayed by the operation state of other axes.
- When using the near-point dog signal and "[Cd.46] Speed-position switching command", the t6 timing time could be delayed or vary influenced by the PLC scan time or communication with servo amplifier.

## Current feed value

The following table shows the "[Md.20] Current feed value" during speed-position switching control (ABS mode) corresponding to the "[Pr.21] Current feed value during speed control" settings.

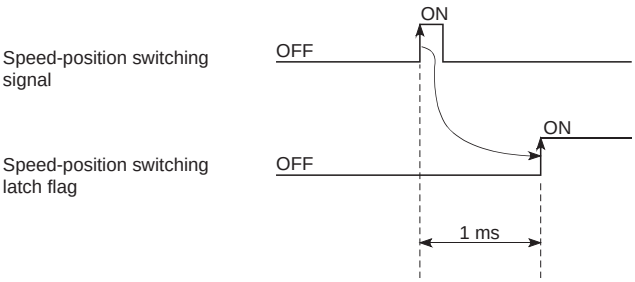
| "[Pr.21] Current feed value during speed control" setting | [Md.20] Current feed value |
|---|---|
| 1: Update current feed value | The current feed value is updated during speed control and position control. |

Only "1: Update current value" is valid for the setting of "[Pr.21] Current feed value during speed control" in speed-position switching control (ABS mode).
The error "Speed-position function selection error" (error code: 1AAEH) will occur if the "[Pr.21] Current feed value during speed control" setting is other than 1.




## Switching time from speed control to position control

It takes 1 ms from the time the speed-position switching signal is turned ON to the time the speed-position switching latch flag ([Md.31] Status: b1) turns ON.



## Speed-position switching signal setting

- The following table shows the items that must be set to use the external command signals [DI] as speed-position switching signals.

n: Axis No. - 1

| Setting item | | Setting value | Setting details | Buffer memory address |
|---|---|---|---|---|
| [Pr.42] | External command function selection | 2 | 2: Speed-position, position-speed switching request. | 62+150n |
| [Cd.8] | External command valid | 1 | 1: Validates an external command. | 4305+100n |
| [Cd.45] | Speed-position switching device selection | 0 | 0: Use the external command signal for switching from speed control to position control. | 4366+100n |

*1 Set the external command signal [DI] in "[Pr.95] External command signal selection". Refer to the followings for information on the setting details.
☞ Page 407 Basic Setting, Page 504 Control Data

- The following table shows the items that must be set to use the near-point dog signal (DOG) as speed-position switching signals.

n: Axis No. - 1

| Setting item | | Setting value | Setting details | Buffer memory address |
|---|---|---|---|---|
| [Cd.45] | Speed-position switching device selection | 1 | 1: Use the near-point dog signal for switching from speed control to position control. | 4366+100n |

*2 The setting is not required for "[Pr.42] External command function selection" and "[Cd.8] External command valid". Refer to the following for information on the setting details.
☞ Page 504 Control Data

- The following table shows the items that must be set to use "[Cd.46] Speed-position switching command" as speed-position switching signals.

n: Axis No. - 1

| Setting item | | Setting value | Setting details | Buffer memory address |
|---|---|---|---|---|
| [Cd.45] | Speed-position switching device selection | 2 | 2: Use the "[Cd.46] Speed-position switching command" for switching from speed control to position control. | 4366+100n |

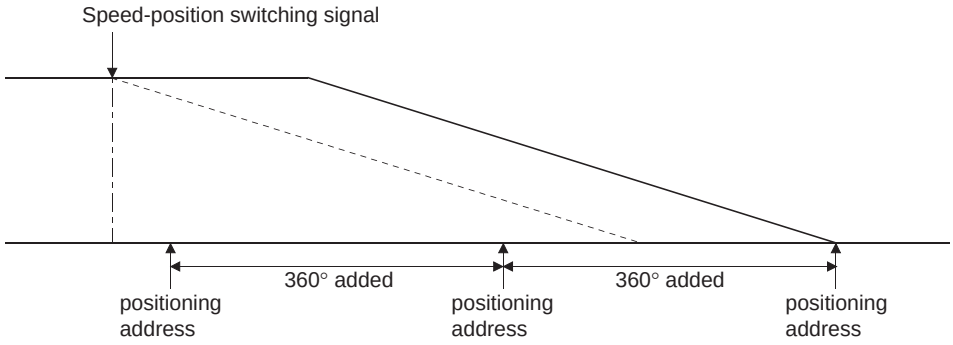
*3 The setting is not required for "[Pr.42] External command function selection" and "[Cd.8] External command valid". Refer to the following for information on the setting details.
☞ Page 504 Control Data

## Restrictions

- The error "Continuous path control not possible" (error code: 1A1EH to 1A20H) will occur and the operation cannot start if "continuous positioning control" or "continuous path control" is set in "[Da.1] Operation pattern".
- "Speed-position switching control" cannot be set in "[Da.2] Control method" of the positioning data when "continuous path control" has been set in "[Da.1] Operation pattern" of the immediately prior positioning data. (For example, if the operation pattern of positioning data No. 1 is "continuous path control", "speed-position switching control" cannot be set in positioning data No. 2.) The error "Continuous path control not possible" (error code: 1A1EH to 1A20H) will occur and the machine will carry out a deceleration stop if this type of setting is carried out.
- The error "No command speed" (error code: 1A12H to 1A14H) will occur if "current speed (-1)" is set in "[Da.8] Command speed".
- If the value set in "[Da.6] Positioning address/movement amount" is negative, the error "Outside address range" (error code: 1A30H, 1A31H) will occur.
- Even though the axis control data "[Cd.23] Speed-position switching control movement amount change register" was set in speed-position switching control (ABS mode), it would not function. The set value is ignored.
- To exercise speed-position switching control (ABS mode), the following conditions must be satisfied:

1) "[Pr.1] Unit setting" is "2: degree"
2) The software stroke limit function is invalid (upper limit value = lower limit value)
3) "[Pr.21] Current feed value during speed control" is "1: Update current feed value"
4) The "[Da.6] Positioning address/movement amount" setting range is 0 to 359.99999 (degree). If the value is outside of the range, the error "Outside address range" (error code: 1A30H, 1A31H) will occur at a start.
5) The "[Pr.81] Speed-position function selection" setting is "2: Speed-position switching control (ABS mode)".

- If any of the conditions in 1) to 3) is not satisfied in the case of 5), the error "Speed-position function selection error" (error code: 1AAEH) will occur when the PLC READY signal [Y0] turns from OFF to ON.
- If the axis reaches the positioning address midway through deceleration after automatic deceleration started at the input of the speed-position switching signal, the axis will not stop immediately at the positioning address. The axis will stop at the positioning address after N revolutions so that automatic deceleration can always be made. (N: Natural number) In the following example, since making deceleration in the path of dotted line will cause the axis to exceed the positioning addresses twice, the axis will decelerate to a stop at the third positioning address.



## Setting positioning data

When using speed-position switching control (ABS mode), set the following positioning data.

◎: Always set, ○: Set as required, —: Setting not required

| Setting item | | Setting required/not required |
|---|---|---|
| [Da.1] | Operation pattern | ◎ |
| [Da.2] | Control method | ◎<br>(Set "Forward run: speed/position" or "Reverse run: speed/position".) |
| [Da.3] | Acceleration time No. | ○ |
| [Da.4] | Deceleration time No. | ○ |
| [Da.6] | Positioning address/movement amount | ◎ |
| [Da.7] | Arc address | — |
| [Da.8] | Command speed | ◎ |
| [Da.9] | Dwell time/JUMP destination positioning data No. | ○ |
| [Da.10] | M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches | ○ |
| [Da.20] | Axis to be interpolated No.1 | — |
| [Da.21] | Axis to be interpolated No.2 | — |
| [Da.22] | Axis to be interpolated No.3 | — |
| [Da.27] | M code ON signal output timing | ○ |
| [Da.28] | ABS direction in degrees | — |
| [Da.29] | Interpolation speed designation method | — |

*1 Refer to the following for information on the setting details.
☞ Page 445 Positioning Data

# Position-speed switching control

In "position-speed switching control" ("[Da.2] Control method" = Forward run: position/speed, Reverse run: position/speed), before the position-speed switching signal is input, position control is carried out for the movement amount set in "[Da.6] Positioning address/movement amount" in the axis direction in which the positioning data has been set. When the position-speed switching signal is input, the position control is carried out by continuously outputting the pulses for the speed set in "[Da.8] Command speed" until the input of a stop command.
The two types of position-speed switching control are "Forward run: position/speed" in which the control starts in the forward run direction, and "Reverse run: position/speed" in which control starts in the reverse run direction.

## Switching over from position control to speed control

- The control is selected the switching method from position control to speed control by the setting value of "[Cd.45] Speed-position switching device selection".

n: Axis No. - 1

| Setting item | | Setting value | Setting details | Buffer memory address |
|---|---|---|---|---|
| [Cd.45] | Speed-position switching device selection | → | The device used for speed-position switching is selected.<br>0: Use the external command signal for switching from position control to speed control<br>1: Use the near-point signal for switching from position control to speed control<br>2: Use the "[Cd.46] Speed-position switching command" for switching from position control to speed control | 4366+100n |

The switching is performed by using the following device when "2" is set.

n: Axis No. - 1

| Setting item | | Setting value | Setting details | Buffer memory address |
|---|---|---|---|---|
| [Cd.46] | Speed-position switching command | → | The speed-position control switching is performed when "2" is set in "[Cd.45] Speed-position switching device selection". | 4367+100n |

- "[Cd.26] Position-speed switching enable flag" must be turned ON to switch over from position control to speed control. (If the "[Cd.26] Position-speed switching enable flag" turns ON after the position-speed switching signal turns ON, the control will continue as position control without switching over to speed control. The control will be switched over from position control to speed control when the position-speed switching signal turns from OFF to ON again. Only speed control will be carried out when the "[Cd.26] Position-speed switching enable flag" and position-speed switching signal are ON at the operation start.)

n: Axis No. - 1

| Setting item | | Setting value | Setting details | Buffer memory address |
|---|---|---|---|---|
| [Cd.26] | Position-speed switching enable flag | 1 | 1: Position control will be taken over by speed control when the external command signal [DI] comes ON. | 4332+100n |

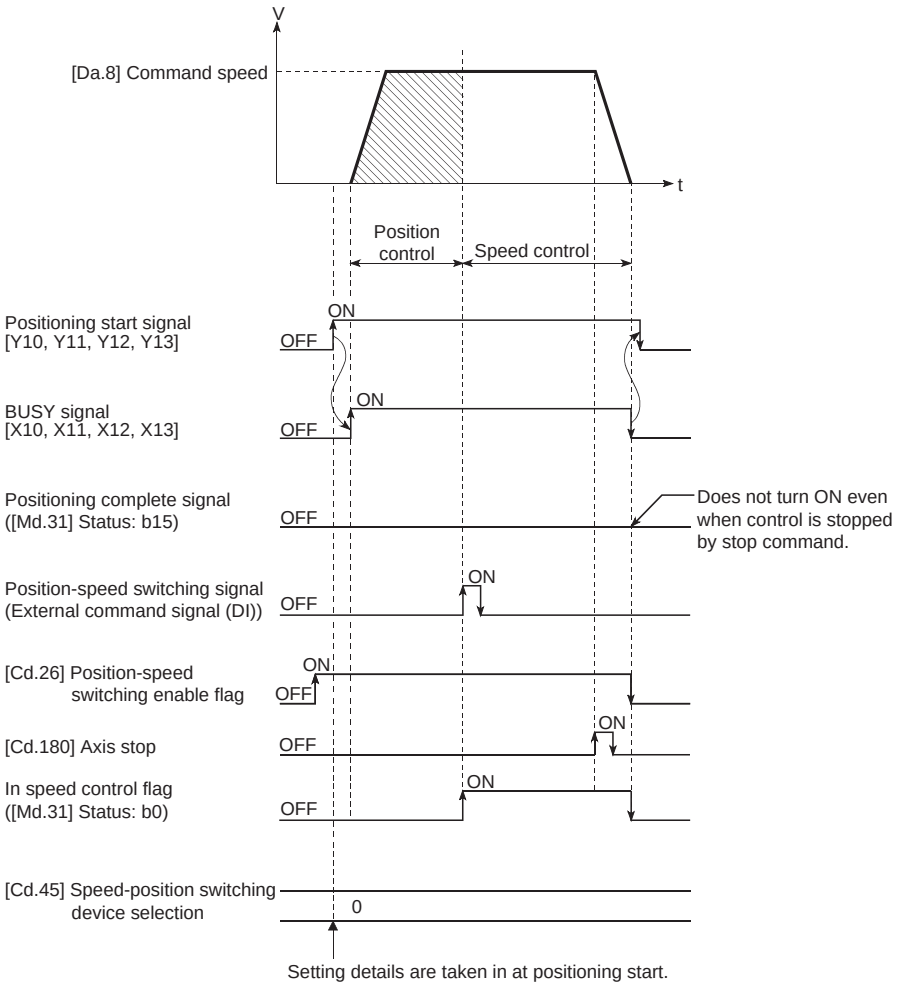
## Operation chart

The following chart shows the operation timing for position-speed switching control.

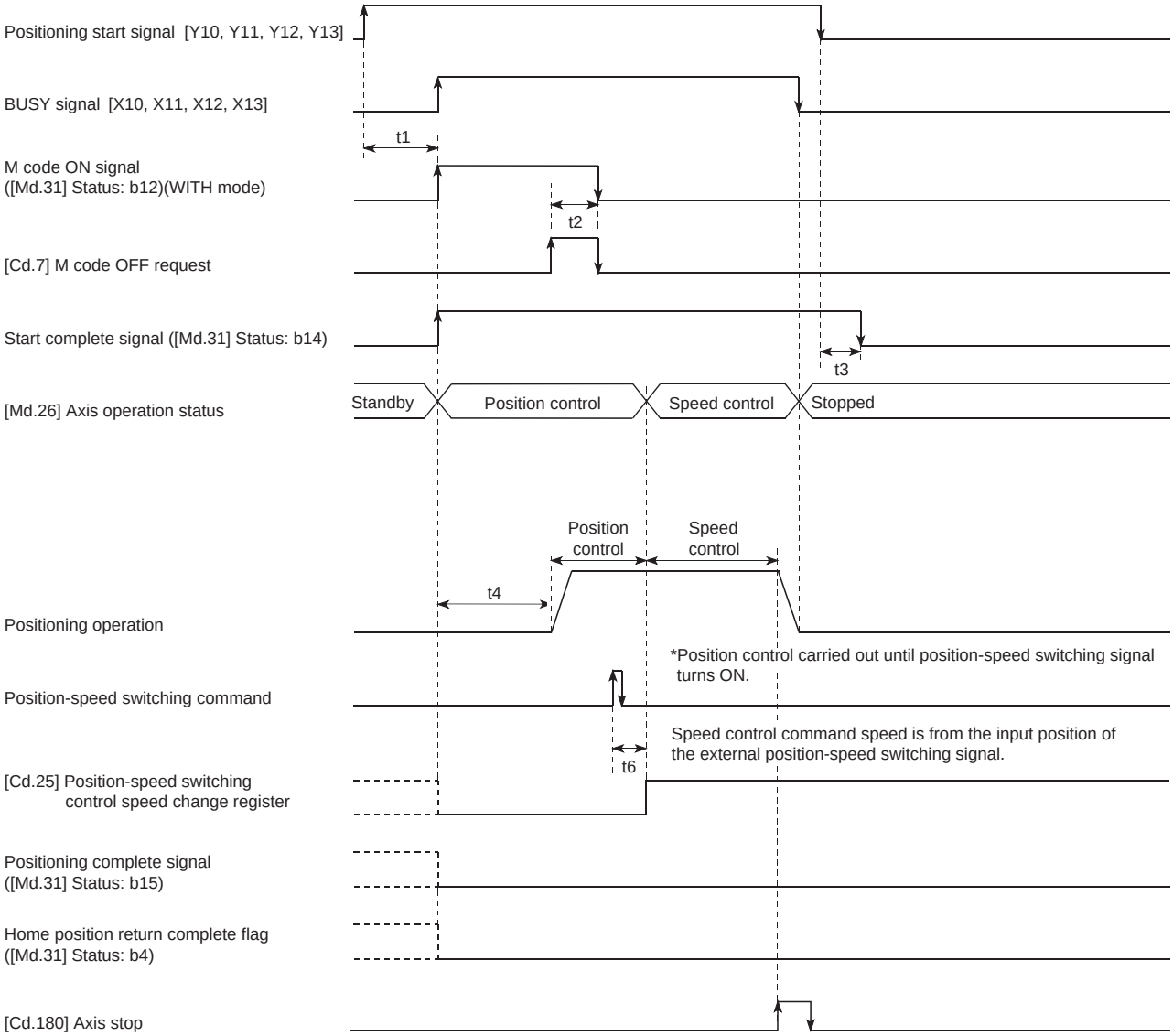
The "in speed control" flag ([Md.31] Status: b0) is turned ON during speed control of position-speed switching control.

### ■RD77MS4 operation example

- When using the external command signal [DI] as position-speed switching signal



## Operation timing and processing time



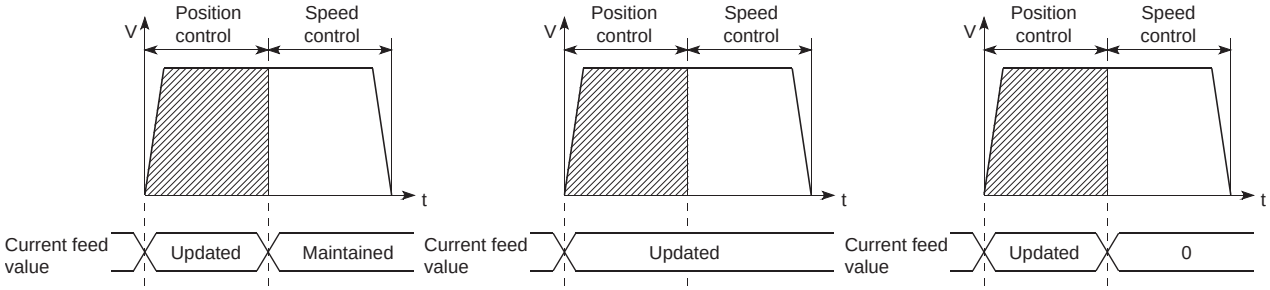

| Operation cycle | Normal timing time Unit: [ms] | | | | | |
|---|---|---|---|---|---|---|
| | t1 | t2 | t3 | t4 | t5 | t6 |
| 0.444 | 0.286 to 1.382 | 0.000 to 0.444 | 0.000 to 0.444 | 0.991 to 1.608 | — | 0.343 |
| 0.888 | 0.286 to 1.382 | 0.000 to 0.888 | 0.000 to 0.888 | 2.165 to 3.009 | — | 0.346 |
| 1.777 | 0.286 to 1.382 | 0.000 to 1.777 | 0.000 to 1.777 | 3.777 to 4.406 | — | 0.347 |
| 3.555 | 0.286 to 1.382 | 0.000 to 3.555 | 0.000 to 3.555 | 5.552 to 7.960 | — | 0.349 |

- The t1 timing time could be delayed by the operation state of other axes.
- When using the near-point dog signal and "[Cd.46] Speed-position switching command", the t6 timing time could be delayed or vary influenced by the PLC scan time or communication with servo amplifier.

## Current feed value

The following table shows the "[Md.20] Current feed value" during position-speed switching control corresponding to the "[Pr.21] Current feed value during speed control" settings.

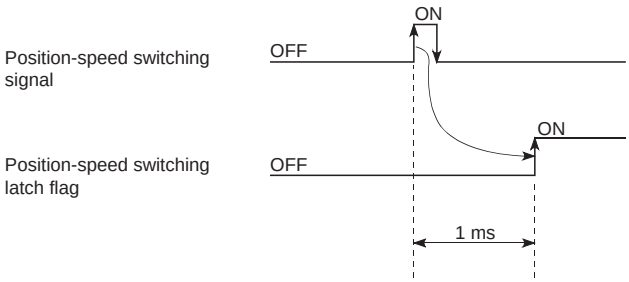
| "[Pr.21] Current feed value during speed control" setting | [Md.20] Current feed value |
|---|---|
| 0: Do not update current feed value | The current feed value is updated during position control, and the current feed value at the time of switching is maintained as soon as position control is switched to speed control. |
| 1: Update current feed value | The current feed value is updated during position control and speed control. |
| 2: Zero clear current feed value | The current feed value is updated during position control, and the current feed value is cleared (to "0") as soon as position control is switched to speed control. |




(a) Current feed value not updated (b) Current feed value updated (c) Current feed value zero cleared

## Switching time from position control to speed control

It takes 1 ms from the time the position-speed switching signal is turned ON to the time the position-speed switching latch flag ([Md.31] Status: b5) turns ON.



## Position-speed switching signal setting

- The following table shows the items that must be set to use the external command signals [DI] as position-speed switching signals.

n: Axis No. - 1

| Setting item | | Setting value | Setting details | Buffer memory address |
|---|---|---|---|---|
| [Pr.42] | External command function selection | 2 | 2: Speed-position, position-speed switching request. | 62+150n |
| [Cd.8] | External command valid | 1 | 1: Validates an external command. | 4305+100n |
| [Cd.45] | Speed-position switching device selection | 0 | 0: Use the external command signal for switching from position control to speed control. | 4366+100n |

*1 Set the external command signal [DI] in "[Pr.95] External command signal selection". Refer to the followings for information on the setting details.
☞ Page 407 Basic Setting, Page 504 Control Data

- The following table shows the items that must be set to use the near-point dog signal (DOG) as position-speed switching signals.

n: Axis No. - 1

| Setting item | | Setting value | Setting details | Buffer memory address |
|---|---|---|---|---|
| [Cd.45] | Speed-position switching device selection | 1 | 1: Use the near-point dog signal for switching from position control to speed control. | 4366+100n |

*2 The setting is not required for "[Pr.42] External command function selection" and "[Cd.8] External command valid". Refer to the following for information on the setting details.
☞ Page 504 Control Data

- The following table shows the items that must be set to use "[Cd.46] Speed-position switching command" as position-speed switching signals.

n: Axis No. - 1

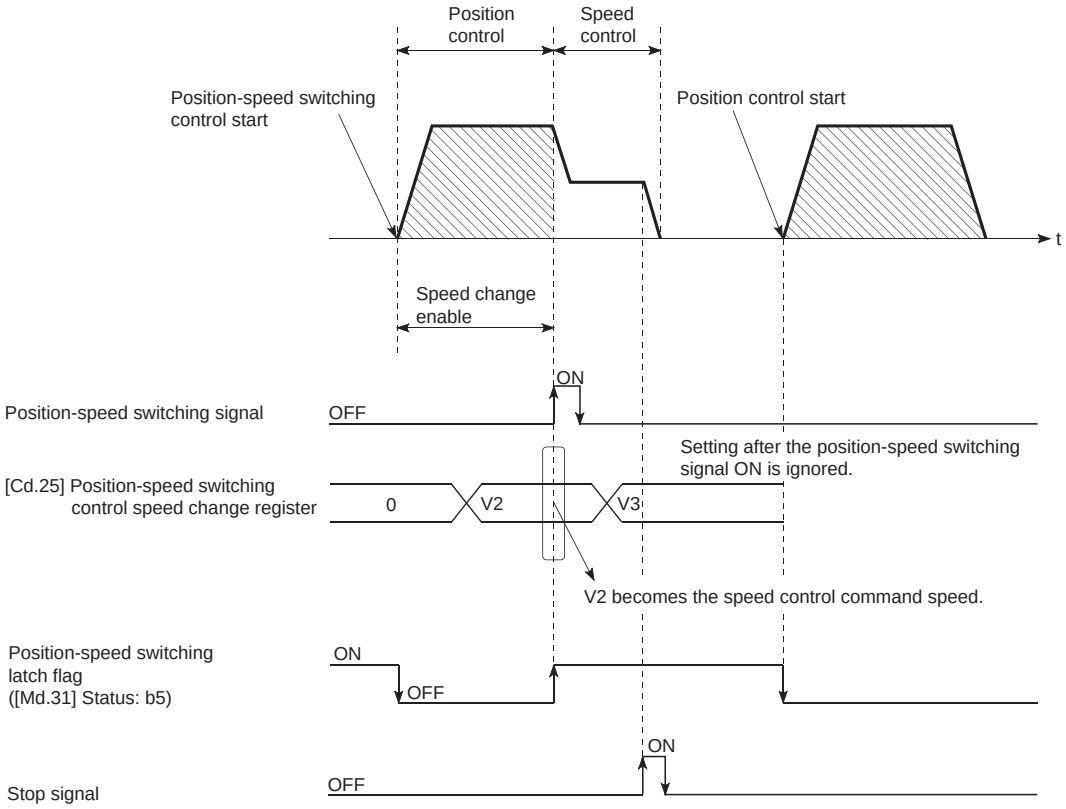
| Setting item | | Setting value | Setting details | Buffer memory address |
|---|---|---|---|---|
| [Cd.45] | Speed-position switching device selection | 2 | 2: Use the "[Cd.46] Speed-position switching command" for switching from position control to speed control. | 4366+100n |

*3 The setting is not required for "[Pr.42] External command function selection" and "[Cd.8] External command valid". Refer to the following for information on the setting details.
☞ Page 504 Control Data

## Changing the speed control command speed

In "position-speed switching control", the speed control command speed can be changed during the position control.

- The speed control command speed can be changed during the position control of position-speed switching control. A command speed change request will be ignored unless issued during the position control of the position-speed switching control.
- The "new command speed" is stored in "[Cd.25] Position-speed switching control speed change register" by the program during position control. This value then becomes the speed control command speed when the position-speed switching signal turns ON.




**Point**

- The machine recognizes the presence of a command speed change request when the data is written to "[Cd.25] Position-speed switching control speed change register" with the program.
- The new command speed is validated after execution of the position-speed switching control before the input of the position-speed switching signal.
- The command speed change can be enabled/disabled with the interlock function in speed control using the "position-speed switching latch flag" ([Md.31] Status: b5) of the axis monitor area.

## Restrictions

- The error "Continuous path control not possible" (error code: 1A1EH to 1A20H) will occur and the operation cannot start if "continuous positioning control" or "continuous path control" is set in "[Da.1] Operation pattern".
- "Position-speed switching control" cannot be set in "[Da.2] Control method" of the positioning data when "continuous path control" has been set in "[Da.1] Operation pattern" of the immediately prior positioning data. (For example, if the operation pattern of positioning data No. 1 is "continuous path control", "position-speed switching control" cannot be set in positioning data No. 2.) The error "Continuous path control not possible" (error code: 1A1EH to 1A20H) will occur and the machine will carry out a deceleration stop if this type of setting is carried out.
- The software stroke limit range is only checked during speed control if the "1: Update current feed value" is set in "[Pr.21] Current feed value during speed control". The software stroke limit range is not checked when the control unit is set to "degree".
- The error "Software stroke limit +" (error code: 1993H) or "Software stroke limit -" (error code: 1995H) will occur and the operation cannot start if the start point address or end point address for position control exceeds the software stroke limit range.
- Deceleration stop will be carried out if the position-speed switching signal is not input before the machine is moved by a specified movement amount. When the position-speed switching signal is input during automatic deceleration by positioning control, acceleration is carried out again to the command speed to continue speed control. When the position-speed switching signal is input during deceleration to a stop with the stop signal, the control is switched to the speed control to stop the machine. Restart is carried out by speed control using the restart command.
- The warning "Speed limit value over" (warning code: 0991H) will occur and control is continued by "[Pr.8] Speed limit value" if a new speed exceeds "[Pr.8] Speed limit value" at the time of change of the command speed.
- If the value set in "[Da.6] Positioning address/movement amount" is negative, the error "Outside address range" (error code: 1A30H, 1A31H) will occur.
- Set WITH mode in the output timing at M code use. The M code will not be output, and the M code ON signal will not turn ON if the AFTER mode is set.

## Setting positioning data

When using position-speed switching control, set the following positioning data.

◎: Always set, ○: Set as required, —: Setting not required

| Setting item | | Setting required/not required |
|---|---|---|
| [Da.1] | Operation pattern | ◎ |
| [Da.2] | Control method | ◎<br>(Set "Forward run: position/speed" or "Reverse run: position/speed".) |
| [Da.3] | Acceleration time No. | ○ |
| [Da.4] | Deceleration time No. | ○ |
| [Da.6] | Positioning address/movement amount | ◎ |
| [Da.7] | Arc address | — |
| [Da.8] | Command speed | ◎ |
| [Da.9] | Dwell time/JUMP destination positioning data No. | ○ |
| [Da.10] | M code/Condition data No./Number of LOOP to LEND repetitions/ Number of pitches | ○ |
| [Da.20] | Axis to be interpolated No.1 | — |
| [Da.21] | Axis to be interpolated No.2 | — |
| [Da.22] | Axis to be interpolated No.3 | — |
| [Da.27] | M code ON signal output timing | ○ |
| [Da.28] | ABS direction in degrees | — |
| [Da.29] | Interpolation speed designation method | — |

*1 Refer to the following for information on the setting details.
☞ Page 445 Positioning Data

# Current value changing

When the current value is changed to a new value, control is carried out in which the "[Md.20] Current feed value" of the stopped axis is changed to a random address set by the user. (The "[Md.21] Machine feed value" is not changed when the current value is changed.)

The two methods for changing the current value are shown below.

- Changing to a new current value using the positioning data
- Changing to a new current value using the start No. (No. 9003) for a current value changing

The current value changing using method [1] is used during continuous positioning of multiple blocks, etc.



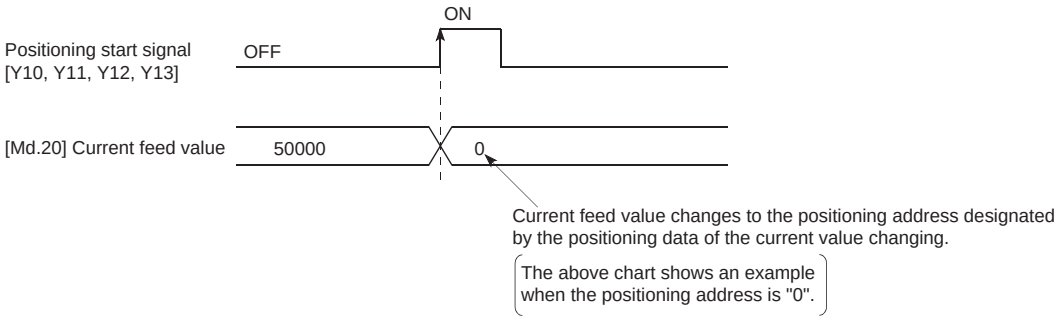
## Changing to a new current value using the positioning data

In "current value changing" ("[Da.2] Control method" = current value changing), "[Md.20] Current feed value" is changed to the address set in "[Da.6] Positioning address/movement amount".

### ■Operation chart

The following chart shows the operation timing for a current value changing. The "[Md.20] Current feed value" is changed to the value set in "[Da.6] Positioning address/movement amount" when the positioning start signal turns ON.

### ■RD77MS4 operation example


ON
Positioning start signal
[Y10, Y11, Y12, Y13]
OFF
[Md.20] Current feed value
50000
0
Current feed value changes to the positioning address designated by the positioning data of the current value changing.
The above chart shows an example when the positioning address is "0".

### ■Restrictions

- The error "New current value not possible" (error code: 1A1CH, 1A1DH) will occur and the operation cannot start if "continuous path control" is set in "[Da.1] Operation pattern". ("Continuous path control" cannot be set in current value changing.)
- "Current value changing" cannot be set in "[Da.2] Control method" of the positioning data when "continuous path control" has been set in "[Da.1] Operation pattern" of the immediately prior positioning data. (For example, if the operation pattern of positioning data No. 1 is "continuous path control", "current value changing" cannot be set in positioning data No. 2.) The error "New current value not possible" (error code: 1A1CH, 1A1DH) will occur and the machine will carry out a deceleration stop if this type of setting is carried out.
- The error "Outside new current value range" (error code: 1997H) will occur and the operation cannot start if "degree" is set in "[Pr.1] Unit setting" and the value set in "[Da.6] Positioning address/movement amount (0 to 359.99999 [degree])" is outside the setting range.
- If the value set in "[Da.6] Positioning address/movement amount" is outside the software stroke limit ([Pr.12], [Pr.13]) setting range, the error "Software stroke limit +" (error code: 1A18H) or "Software stroke limit -" (error code: 1A1AH) will occur at the positioning start, and the operation will not start.
- The error "Software stroke limit +" (error code: 1993H) or "Software stroke limit -" (error code: 1995H) will occur if the new current value is outside the software stroke limit range.
- The new current value using the positioning data (No.1 to 600) cannot be changed, if "0: Positioning control is not executed" is set in "[Pr.55] Operation setting for incompletion of home position return" and "home position return request flag" ON. The error "Start at home position return incomplete" (error code: 19A6H) will occur.

## ■Setting positioning data

When using current value changing, set the following positioning data.

◎: Always set, ○: Set as required, —: Setting not required

| Setting item | | Setting required/not required |
|---|---|---|
| [Da.1] | Operation pattern | ◎ |
| [Da.2] | Control method | ◎<br>(Set the current value changing.) |
| [Da.3] | Acceleration time No. | — |
| [Da.4] | Deceleration time No. | — |
| [Da.6] | Positioning address/movement amount | ◎<br>(Set the address to be changed.) |
| [Da.7] | Arc address | — |
| [Da.8] | Command speed | — |
| [Da.9] | Dwell time/JUMP destination positioning data No. | — |
| [Da.10] | M code/Condition data No./Number of LOOP to LEND repetitions/ Number of pitches | ○ |
| [Da.20] | Axis to be interpolated No.1 | — |
| [Da.21] | Axis to be interpolated No.2 | — |
| [Da.22] | Axis to be interpolated No.3 | — |
| [Da.27] | M code ON signal output timing | ○ |
| [Da.28] | ABS direction in degrees | — |
| [Da.29] | Interpolation speed designation method | — |

*1 Refer to the following for information on the setting details.
☞ Page 445 Positioning Data

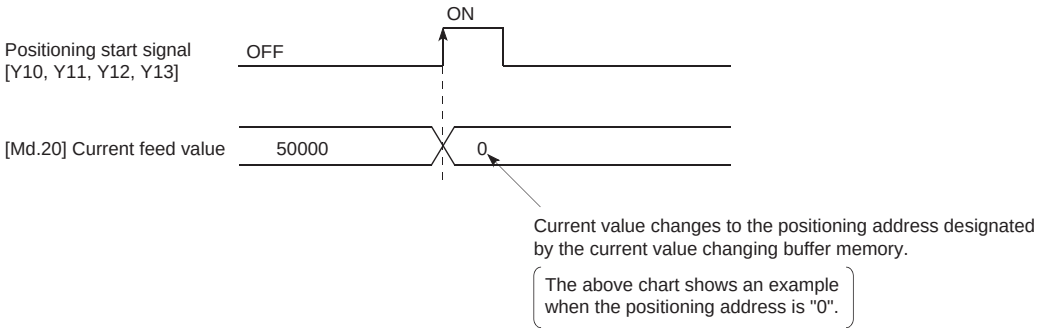
## Changing to a new current value using the current value changing start No. (No. 9003)

In "current value changing" ("[Cd.3] Positioning start No." = 9003), "[Md.20] Current feed value" is changed to the address set in "[Cd.9] New current value".

### ■Operation chart

The current value is changed by setting the new current value in the current value changing buffer memory "[Cd.9] New current value", setting "9003" in the "[Cd.3] Positioning start No.", and turning ON the positioning start signal.

### ■RD77MS4 operation example


ON
Positioning start signal
[Y10, Y11, Y12, Y13]
OFF
[Md.20] Current feed value
50000
0
Current value changes to the positioning address designated by the current value changing buffer memory.
The above chart shows an example when the positioning address is "0".

### ■Restrictions

- The error "Outside new current value range" (error code: 1997H) will occur if the designated value is outside the setting range when "degree" is set in "Unit setting".
- The error "Software stroke limit +" (error code: 1993H) or "Software stroke limit -" (error code: 1995H) will occur if the designated value is outside the software stroke limit range.
- The current value cannot be changed during stop commands and while the M code ON signal is ON.
- The M code output function is made invalid.

**Point**

The new current value can be changed using the current value changing start No. (No. 9003) if "0: Positioning control is not executed" is set in "[Pr.55] Operation setting for incompletion of home position return" and home position return request flag is ON.

### ■Current value changing procedure

The following shows the procedure for changing the current value to a new value.

1. Write the current value to "[Cd. 9] New current value".
2. Write "9003" in "[Cd. 3] Positioning start No.".
3. Turn ON the positioning start signal.

## ■Setting method for the current value changing function

The following shows an example of a program and data setting to change the current value to a new value with the positioning start signal. (The "[Md.20] Current feed value" value is changed to "5000.0 μm" in the example shown.)

- Set the following data. (Set using the program referring to the start time chart.)

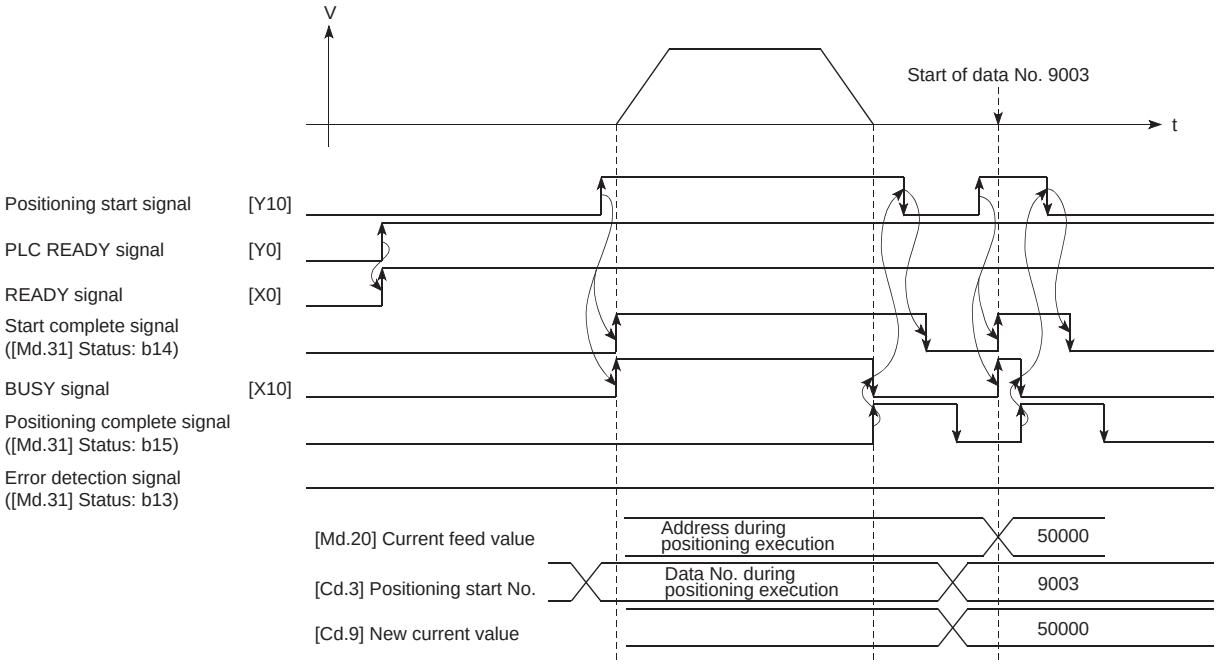
n: Axis No. - 1

| Setting item | | Setting value | Setting details | Buffer memory address |
|---|---|---|---|---|
| [Cd.3] | Positioning start No. | 9003 | Set the start No. "9003" for the new current value. | 4300+100n |
| [Cd.9] | New current value | 50000 | Set the new "[Md.20] Current feed value". | 4306+100n<br>4307+100n |

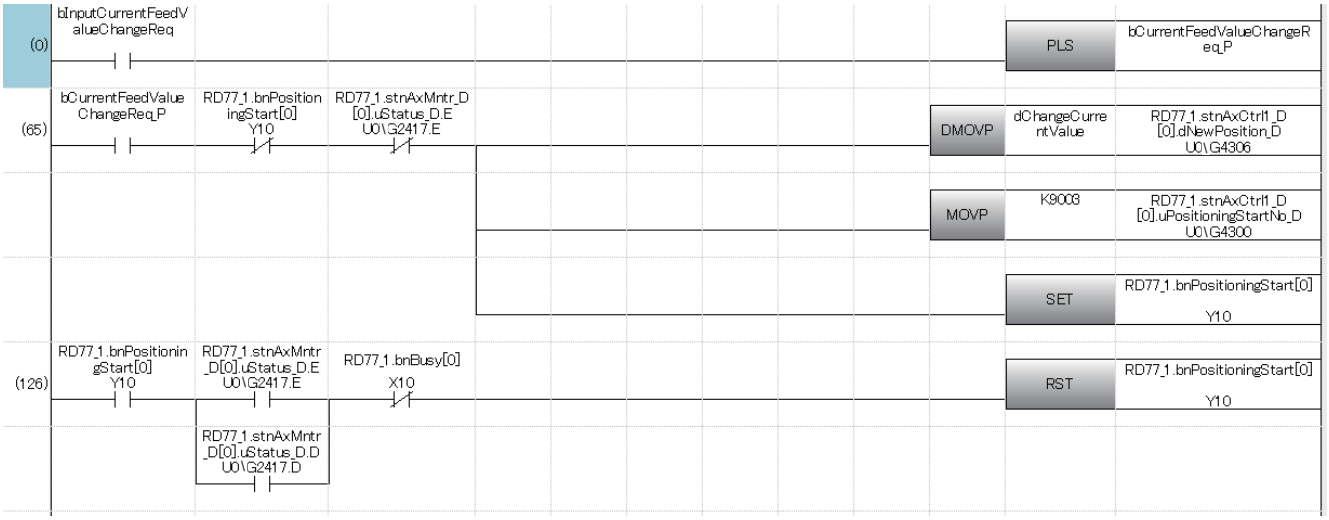
*1 Refer to the following for details on the setting details.
☞ Page 504 Control Data

- The following shows a start time chart.

## ■RD77MS4 operation example



• Add the following program to the control program, and write it to the CPU module.




| Classification | Label name | Description |
|---|---|---|
| Module label | RD77_1.bnPositioningStart[0] | Axis 1 Positioning start |
| | RD77_1.stnAxMntr_D[0].uStatus_D.E | Axis 1 Positioning complete |
| | RD77_1.stnAxCtrl1_D[0].dNewPosition_D | Axis 1 New current value |
| | RD77_1.stnAxCtrl1_D[0].uPositioningStartNo_D | Axis 1 Positioning start No. |
| | RD77_1.stnAxMntr_D[0].uStatus_D.D | Axis 1 Start complete |
| | RD77_1.bnBusy[0] | Axis 1 BUSY signal |
| Global label, local label | Defines the global label or the local label as follows. The settings of Assign (Device/Label) are not required for the label that the assignment device is not set because the unused internal relay and data device are automatically assigned. | |

| | Label Name | Data Type | | Class |
|---|---|---|---|---|
| 1 | bInputCurrentFeedValueChangeReq | Bit | ... | VAR |
| 2 | bCurrentFeedValueChangeReq_P | Bit | ... | VAR |
| 3 | dChangeCurrentValue | Double Word [Signed] | ... | VAR |
| 4 | | | ... | |

# NOP instruction

The NOP instruction is used for the nonexecutable control method.

## Operation

The positioning data No. to which the NOP instruction is set transfers, without any processing, to the operation for the next positioning data No.

## Setting positioning data

When using the NOP instruction, set the following positioning data.

◎: Always set, ○: Set as required, —: Setting not required

| Setting item | | Setting required/not required |
|---|---|---|
| [Da.1] | Operation pattern | — |
| [Da.2] | Control method | ◎<br>(Set the NOP instruction.) |
| [Da.3] | Acceleration time No. | — |
| [Da.4] | Deceleration time No. | — |
| [Da.6] | Positioning address/movement amount | — |
| [Da.7] | Arc address | — |
| [Da.8] | Command speed | — |
| [Da.9] | Dwell time/JUMP destination positioning data No. | — |
| [Da.10] | M code/Condition data No./Number of LOOP to LEND repetitions/ Number of pitches | — |
| [Da.20] | Axis to be interpolated No.1 | — |
| [Da.21] | Axis to be interpolated No.2 | — |
| [Da.22] | Axis to be interpolated No.3 | — |
| [Da.27] | M code ON signal output timing | — |
| [Da.28] | ABS direction in degrees | — |
| [Da.29] | Interpolation speed designation method | — |

*1 Refer to the following for information on the setting details.
☞ Page 445 Positioning Data

## Restrictions

The error "Control method setting error" (error code: 199CH) will occur if the "NOP instruction" is set for the control method of the positioning data No. 600.

**Point**

Use example of NOP instruction

If there is a possibility of speed switching or temporary stop (automatic deceleration) at a point between two points during positioning, that data can be reserved with the NOP instruction to change the data merely by the replacement of the identifier.

# JUMP instruction

The JUMP instruction is used to control the operation so it jumps to a positioning data No. set in the positioning data during "continuous positioning control" or "continuous path control".
JUMP instruction includes the following two types of JUMP.

| JUMP instruction | Description |
|---|---|
| Unconditional JUMP | When execution conditions are not set for the JUMP instruction (When "0" is set to the condition data No.) |
| Conditional JUMP | When execution conditions are set for the JUMP instruction (The conditions are set to the "condition data" used with "high-level positioning control".) |

Using the JUMP instruction enables repeating of the same positioning control, or selection of positioning data by the execution conditions during "continuous positioning control" or "continuous path control".

## Operation

### ■Unconditional JUMP

The JUMP instruction is unconditionally executed. The operation jumps to the positioning data No. set in "[Da.9] Dwell time/JUMP destination positioning data No.".

### ■Conditional JUMP

The block start condition data is used as the JUMP instruction execution conditions.

- When block positioning data No. 7000 to 7004 is started: Each block condition data is used.
- When positioning data No. 1 to 600 is started: Start block 0 condition data is used.
- When the execution conditions set in "[Da.10] M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches" of the JUMP instruction have been established: the JUMP instruction is executed to jump the operation to the positioning data No. set in "[Da.9] Dwell time/JUMP destination positioning data No.".
- When the execution conditions set in "[Da.10] M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches" of the JUMP instruction have not been established: the JUMP instruction is ignored, and the next positioning data No. is executed.

## Restrictions

- When using a conditional JUMP instruction, establish the JUMP instruction execution conditions by the 4th positioning data No. before the JUMP instruction positioning data No.. If the JUMP instruction execution conditions are not established by the time the 4th positioning control is carried out before the JUMP instruction positioning data No., the operation will be processed as an operation without established JUMP instruction execution conditions. (During execution of continuous path control/continuous positioning control, the Simple Motion module calculates the positioning data of the positioning data No. four items ahead of the current positioning data.)
- Set JUMP instruction to positioning data No. that "continuous positioning control" or "continuous path control" is set in operation pattern. It cannot set to positioning data No. that "positioning complete" is set in operation pattern.
- Positioning control such as loops cannot be executed by conditional JUMP instructions alone until the conditions have been established. When loop control is executed using JUMP instruction, an axis operation status is "analyzing" during loop control, and the positioning data analysis (start) for other axes are not executed. As the target of the JUMP instruction, specify a positioning data that is controlled by other than JUMP and NOP instructions.

## Setting positioning data

When using the JUMP instruction, set the following positioning data.

◎: Always set, ○: Set as required, —: Setting not required

| Setting item | | Setting required/not required |
|---|---|---|
| [Da.1] | Operation pattern | — |
| [Da.2] | Control method | ◎<br>(Set the JUMP instruction.) |
| [Da.3] | Acceleration time No. | — |
| [Da.4] | Deceleration time No. | — |
| [Da.6] | Positioning address/movement amount | — |
| [Da.7] | Arc address | — |
| [Da.8] | Command speed | — |
| [Da.9] | Dwell time/JUMP destination positioning data No. | ◎<br>(Set the positioning data No.1 to 600 for the JUMP destination.) |
| [Da.10] | M code/Condition data No./Number of LOOP to LEND repetitions/ Number of pitches | ◎<br>(Set the JUMP instruction execution conditions with the condition data No.<br>0: Unconditional JUMP<br>1 to 10: Condition data No. ("Simultaneous start" condition data cannot be set.)) |
| [Da.20] | Axis to be interpolated No.1 | — |
| [Da.21] | Axis to be interpolated No.2 | — |
| [Da.22] | Axis to be interpolated No.3 | — |
| [Da.27] | M code ON signal output timing | — |
| [Da.28] | ABS direction in degrees | — |
| [Da.29] | Interpolation speed designation method | — |

*1 Refer to the following for information on the setting details.
☞ Page 445 Positioning Data

# LOOP

The LOOP is used for loop control by the repetition of LOOP to LEND.

## Operation

The LOOP to LEND loop is repeated by set repeat cycles.

## Setting positioning data

When using the LOOP, set the following positioning data.

◎: Always set, ○: Set as required, —: Setting not required

| Setting item | | Setting required/not required |
|---|---|---|
| [Da.1] | Operation pattern | — |
| [Da.2] | Control method | ◎<br>(Set the LOOP.) |
| [Da.3] | Acceleration time No. | — |
| [Da.4] | Deceleration time No. | — |
| [Da.6] | Positioning address/movement amount | — |
| [Da.7] | Arc address | — |
| [Da.8] | Command speed | — |
| [Da.9] | Dwell time/JUMP destination positioning data No. | — |
| [Da.10] | M code/Condition data No./Number of LOOP to LEND repetitions/ Number of pitches | ◎<br>(Set the repeat cycles.) |
| [Da.20] | Axis to be interpolated No.1 | — |
| [Da.21] | Axis to be interpolated No.2 | — |
| [Da.22] | Axis to be interpolated No.3 | — |
| [Da.27] | M code ON signal output timing | — |
| [Da.28] | ABS direction in degrees | — |
| [Da.29] | Interpolation speed designation method | — |

*1 Refer to the following for information on the setting details.
☞ Page 445 Positioning Data

## Restrictions

- The error "Control method LOOP setting error" (error code: 1A33H) will occur if a "0" is set for the repeat cycles.
- Even if LEND is absent after LOOP, no error will occur, but repeat processing will not be carried out.
- Nesting is not allowed between LOOP-LEND's. If such setting is made, only the inner LOOP-LEND is processed repeatedly.

**Point**

The setting by this control method is easier than that by the special start "FOR loop". (☞ Page 153 Repeated start (FOR loop))

- For special start: Positioning start data, special start data, condition data, and positioning data
- For control method: Positioning data

For the special start FOR to NEXT, the positioning data is required for each of FOR and NEXT points. For the control method, loop can be executed even only by one data.

Also, nesting is enabled by using the control method LOOP to LEND in combination with the special start FOR to NEXT. However LOOP to LEND cannot be set across block. Always set LOOP to LEND so that the processing ends within one block.

For details of the "block", refer to the following.

☞ Page 143 HIGH-LEVEL POSITIONING CONTROL

# LEND

The LEND is used to return the operation to the top of the repeat (LOOP to LEND) loop.

## Operation

When the repeat cycle designated by the LOOP becomes 0, the loop is terminated, and the next positioning data No. processing is started. (The operation pattern, if set to "Positioning complete", will be ignored.)
When the operation is stopped after the repeat operation is executed by designated cycles, the dummy positioning data (for example, incremental positioning without movement amount) is set next to LEND.
The following table shows the operation when the positioning complete (00) is set to LOOP and LEND.

| Positioning data No. | Operation pattern | Control method | Conditions | Operation |
|---|---|---|---|---|
| 1 | Continuous control | ABS2 | | Executed in the order of the positioning data No. 1 → 2 → 3 → 4 → 5 → 2 → 3 → 4 → 5 → 6.<br>(The operation patterns of the positioning data Nos. 2 and 5 are ignored.) |
| 2 | Positioning complete | LOOP | Number of loop cycles: 2 | |
| 3 | Continuous path control | ABS2 | | |
| 4 | Continuous control | ABS2 | | |
| 5 | Positioning complete | LEND | | |
| 6 | Positioning complete | ABS2 | | |

## Setting positioning data

When using the LEND, set the following positioning data.
◎: Always set, ○: Set as required, —: Setting not required

| Setting item | | Setting required/not required |
|---|---|---|
| [Da.1] | Operation pattern | — |
| [Da.2] | Control method | ◎<br>(Set the LEND.) |
| [Da.3] | Acceleration time No. | — |
| [Da.4] | Deceleration time No. | — |
| [Da.6] | Positioning address/movement amount | — |
| [Da.7] | Arc address | — |
| [Da.8] | Command speed | — |
| [Da.9] | Dwell time/JUMP destination positioning data No. | — |
| [Da.10] | M code/Condition data No./Number of LOOP to LEND repetitions/ Number of pitches | — |
| [Da.20] | Axis to be interpolated No.1 | — |
| [Da.21] | Axis to be interpolated No.2 | — |
| [Da.22] | Axis to be interpolated No.3 | — |
| [Da.27] | M code ON signal output timing | — |
| [Da.28] | ABS direction in degrees | — |
| [Da.29] | Interpolation speed designation method | — |

*1 Refer to the following for information on the setting details.
☞ Page 445 Positioning Data

## Restrictions

- Ignore the "LEND" before the "LOOP" is executed.
- When the operation pattern "Positioning complete" has been set between LOOP and LEND, the positioning control is completed after the positioning data is executed, and the LOOP control is not executed.

# 4 HIGH-LEVEL POSITIONING CONTROL

The details and usage of high-level positioning control (control functions using the "block start data") are explained in this chapter.
High-level positioning control is used to carry out applied control using the "positioning data". Examples of applied control are using conditional judgment to control "positioning data" set with the major positioning control, or simultaneously starting "positioning data" for several different axes.
Read the execution procedures and settings for each control, and set as required.

## 4.1 Outline of High-level Positioning Control



In "high-level positioning control" the execution order and execution conditions of the "positioning data" are set to carry out more applied positioning. (The execution order and execution conditions are set in the "block start data" and "condition data".)
The following applied positioning controls can be carried out with "high-level positioning control".

| High-level positioning control | Details |
|---|---|
| Block[*1] start (Normal start) | With one start, executes the positioning data in a random block with the set order. |
| Condition start | Carries out condition judgment set in the "condition data" for the designated positioning data, and then executes the "block start data".<br>• When the condition is established, the "block start data" is executed.<br>• When not established, that "block start data" is ignored, and the next point's "block start data" is executed. |
| Wait start | Carries out condition judgment set in the "condition data" for the designated positioning data, and then executes the "block start data".<br>• When the condition is established, the "block start data" is executed.<br>• When not established, stops the control until the condition is established. (Waits.) |
| Simultaneous start[*2] | Simultaneously executes the positioning data having the No. for the axis designated with the "condition data". (Outputs command at the same timing.) |
| Repeated start (FOR loop) | Repeats the program from the "block start data" set with the "FOR loop" to the "block start data" set in "NEXT" for the designated number of times. |
| Repeated start (FOR condition) | Repeats the program from the "block start data" set with the "FOR condition" to the "block start data" set in "NEXT" until the conditions set in the "condition data" are established. |

*1 "1 block" is defined as all the data continuing from the positioning data in which "continuous positioning control" or "continuous path control" is set in the "[Da.1] Operation pattern" to the positioning data in which "independent positioning control (Positioning complete)" is set.
*2 Besides the simultaneous start of "block start data" system, the "simultaneous starts" include the "multiple axes simultaneous start control" of control method. Refer to the following for details.
☞ Page 23 Multiple axes simultaneous start

### High-level positioning control sub functions

"High-level positioning control" uses the "positioning data" set with the "major positioning control". Refer to the following for details on sub functions that can be combined with the major positioning control.
📖MELSEC iQ-R Simple Motion Module User's Manual (Startup)
Note that the pre-reading start function cannot be used together with "high-level positioning control".

# Data required for high-level positioning control

"High-level positioning control" is executed by setting the required items in the "block start data" and "condition data", then starting that "block start data". Judgment about whether execution is possible, etc., is carried out at execution using the "condition data" designated in the "block start data".

"Block start data" can be set for each No. from 7000 to 7004 (called "block Nos."), and up to 50 points can be set for each axis. (This data is controlled with Nos. called "points" to distinguish it from the positioning data. For example, the 1st block start data item is called the "1st point block start data" or "point No. 1 block start data".)

"Condition data" can be set for each No. from 7000 to 7004 (called "block Nos."), and up to 10 data items can be set for each axis.

The "block start data" and "condition data" are set as 1 set for each block No.

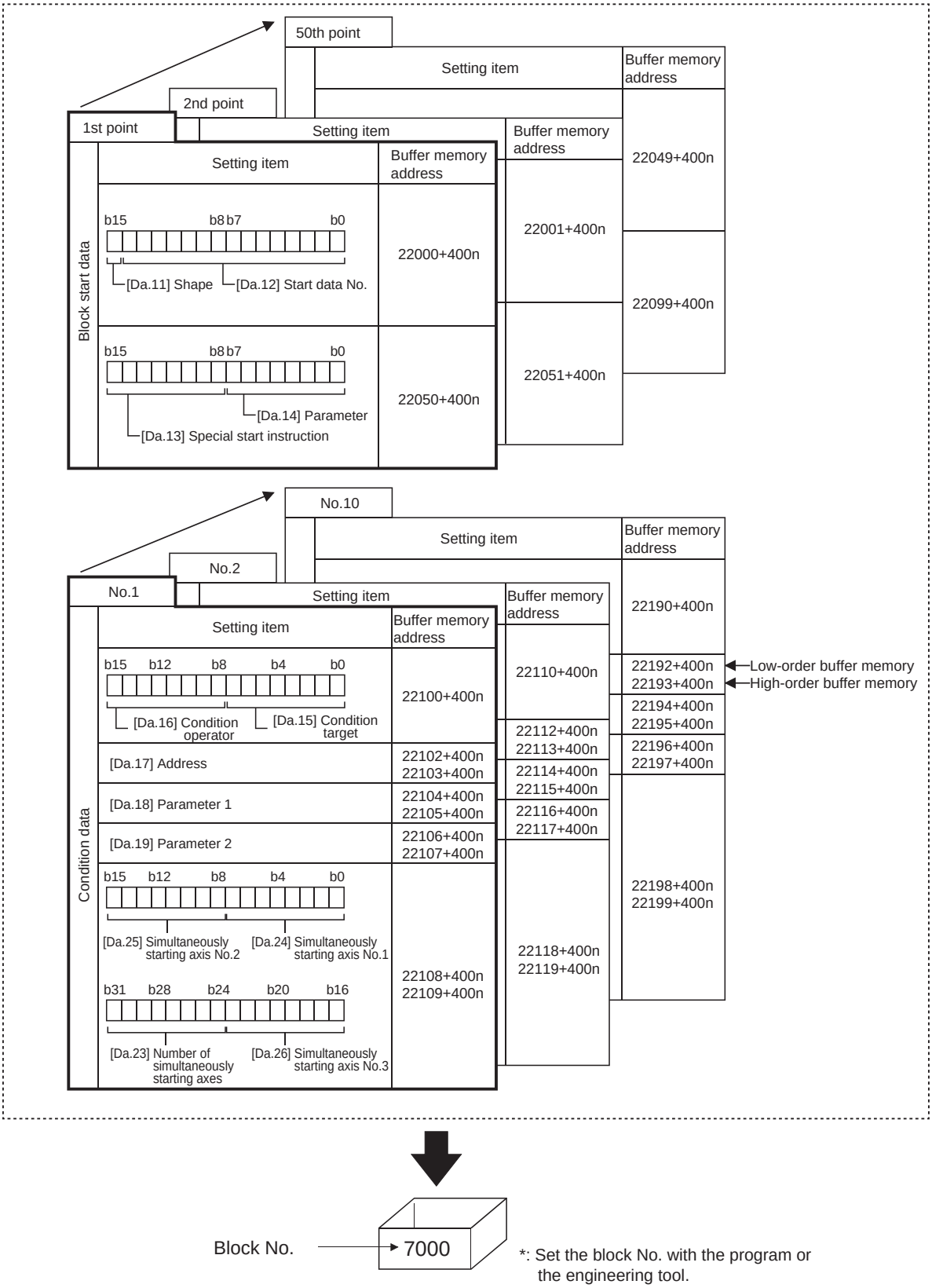
The following table shows an outline of the "block start data" and "condition data" stored in the Simple Motion module.

| Setting item | | | Setting details |
|---|---|---|---|
| Block start data | [Da.11] | Shape | Set whether to end the control after executing only the "block start data" of the shape itself, or continue executing the "block start data" set in the next point. |
| | [Da.12] | Start data No. | Set the "positioning data No." to be executed. |
| | [Da.13] | Special start instruction | Set the method by which the positioning data set in [Da.12] will be started. |
| | [Da.14] | Parameter | Set the conditions by which the start will be executed according to the commands set in [Da.13]. (Designate the "condition data No." and "Number of repetitions".) |

| Setting item | | | Setting details |
|---|---|---|---|
| Condition data | [Da.15] | Condition target | Designate the "device", "buffer memory storage details", and "positioning data No." elements for which the conditions are set. |
| | [Da.16] | Condition operator | Set the judgment method carried out for the target set in [Da.15]. |
| | [Da.17] | Address | Set the buffer memory address in which condition judgment is carried out (only when the details set in [Da.15] are "buffer memory storage details"). |
| | [Da.18] | Parameter 1 | Set the required conditions according to the details set in [Da.15], [Da.16] and [Da.23]. |
| | [Da.19] | Parameter 2 | |
| | [Da.23] | Number of simultaneously starting axes | Set the number of axes to be started simultaneously in the simultaneously start. |
| | [Da.24] | Simultaneously starting axis No.1 | Set the simultaneously starting axis in the simultaneously start. |
| | [Da.25] | Simultaneously starting axis No.2 | |
| | [Da.26] | Simultaneously starting axis No.3 | |

# "Block start data" and "condition data" configuration

The "block start data" and "condition data" corresponding to "block No. 7000" can be stored in the buffer memory.







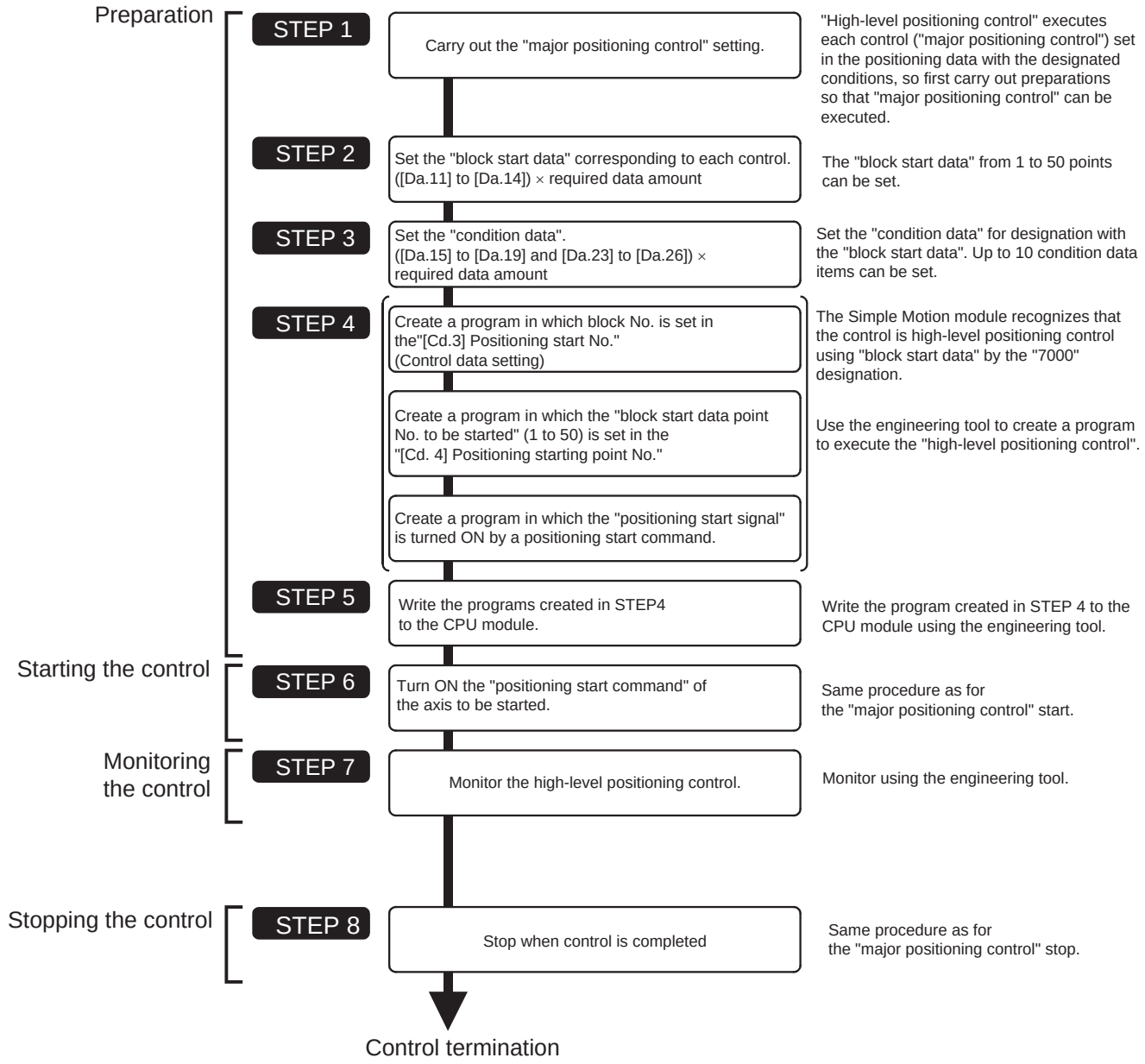
*: Set the block No. with the program or the engineering tool.

Set the "block start data" and "condition data" corresponding to the following "block Nos. 7001 to 7004" using the program or the engineering tool to Simple Motion module.

The "block start data" and "condition data" corresponding to "block No. 7002 to 7004" are not allocated. Set the data with the engineering tool.

# 4.2 High-level Positioning Control Execution Procedure

High-level positioning control is carried out using the following procedure.


Preparation
STEP 1
Carry out the "major positioning control" setting.
"High-level positioning control" executes each control ("major positioning control") set in the positioning data with the designated conditions, so first carry out preparations so that "major positioning control" can be executed.
STEP 2
Set the "block start data" corresponding to each control. ([Da.11] to [Da.14]) × required data amount
The "block start data" from 1 to 50 points can be set.
STEP 3
Set the "condition data". ([Da.15] to [Da.19] and [Da.23] to [Da.26]) × required data amount
Set the "condition data" for designation with the "block start data". Up to 10 condition data items can be set.
STEP 4
Create a program in which block No. is set in the"[Cd.3] Positioning start No." (Control data setting)
The Simple Motion module recognizes that the control is high-level positioning control using "block start data" by the "7000" designation.
Create a program in which the "block start data point No. to be started" (1 to 50) is set in the "[Cd. 4] Positioning starting point No."
Use the engineering tool to create a program to execute the "high-level positioning control".
Create a program in which the "positioning start signal" is turned ON by a positioning start command.
STEP 5
Write the programs created in STEP4 to the CPU module.
Write the program created in STEP 4 to the CPU module using the engineering tool.
Starting the control
STEP 6
Turn ON the "positioning start command" of the axis to be started.
Same procedure as for the "major positioning control" start.
Monitoring the control
STEP 7
Monitor the high-level positioning control.
Monitor using the engineering tool.
Stopping the control
STEP 8
Stop when control is completed
Same procedure as for the "major positioning control" stop.
Control termination

**Point**

- Five sets of "block start data (50 points)" and "condition data (10 items)" corresponding to "No. 7000 to 7004" are set with a program.
- Five sets corresponding to "7000" to "7004" can be set with an engineering tool as well. When writing to the Simple Motion module after setting the "block start data" and the "condition data" corresponding to "7000" to "7004" using an engineering tool, "7000" to "7004" can be set in "[Cd.3] Positioning start No." on STEP4.

# 4.3 Setting the Block Start Data

## Relation between various controls and block start data

The "block start data" must be set to carry out "high-level positioning control".

The setting requirements and details of each "block start data" item to be set differ according to the "[Da.13] Special start instruction" setting.

The following shows the "block start data" setting items corresponding to various control methods.

Also refer to the following for details on "condition data" with which control execution is judged.

☞ Page 156 Setting the Condition Data

(The "block start data" settings in this chapter are assumed to be carried out using the engineering tool.)

◎: One of the two setting items must be set.

○: Set as required (Set to "—" when not used.)

×: Setting not possible

—: Setting not required (The setting value is invalid. Set the initial value or a value within the setting range.)

| Block start data setting items | | | Block start (Normal start) | Condition start | Wait start | Simultaneous start | Repeated start (FOR loop) | Repeated start (FOR condition) | NEXT start*1 |
|---|---|---|---|---|---|---|---|---|---|
| [Da.11] | Shape | 0: End | ◎ | ◎ | ◎ | ◎ | × | × | ◎ |
| | | 1: Continue | ◎ | ◎ | ◎ | ◎ | ◎ | ◎ | ◎ |
| [Da.12] | Start data No. | | 1 to 600 | | | | | | |
| [Da.13] | Special start instruction | | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| [Da.14] | Parameter | | — | Condition data No. | | | Number of repetitions | Condition data No. | — |

*1 The "NEXT start" instruction is used in combination with "repeated start (FOR loop)" and "repeated start (FOR condition)". Control using only the "NEXT start" will not be carried out.

**Point**

It is recommended that the "block start data" be set whenever possible with the engineering tool. Execution by a program uses many programs and devices. The execution becomes complicated, and the scan times will increase.

# Block start

In a "block start (normal start)", the positioning data groups of a block are continuously executed in a set PLC starting from the positioning data set in "[Da.12] Start data No." by one start.

The control examples are shown when the "block start data" and "positioning data" are set as shown in the setting examples.

## Setting examples

### ■Block start data setting example

| Axis 1 block start data | [Da.11] Shape | [Da.12] Start data No. | [Da.13] Special start instruction | [Da.14] Parameter |
|---|---|---|---|---|
| 1st point | 1: Continue | 1 | 0: Block start | — |
| 2nd point | 1: Continue | 2 | 0: Block start | — |
| 3rd point | 1: Continue | 5 | 0: Block start | — |
| 4th point | 1: Continue | 10 | 0: Block start | — |
| 5th point | 0: End | 15 | 0: Block start | — |
| ⋮ | | | | |

### ■Positioning data setting example

| Axis 1 positioning data No. | [Da.1] Operation pattern | |
|---|---|---|
| 1 | 00: Positioning complete | |
| 2 | 11: Continuous path control | 1 block[*1] |
| 3 | 01: Continuous positioning control | |
| 4 | 00: Positioning complete | |
| 5 | 11: Continuous path control | 1 block |
| 6 | 00: Positioning complete | |
| ⋮ | | |
| 10 | 00: Positioning complete | |
| ⋮ | | |
| 15 | 00: Positioning complete | |
| ⋮ | | |

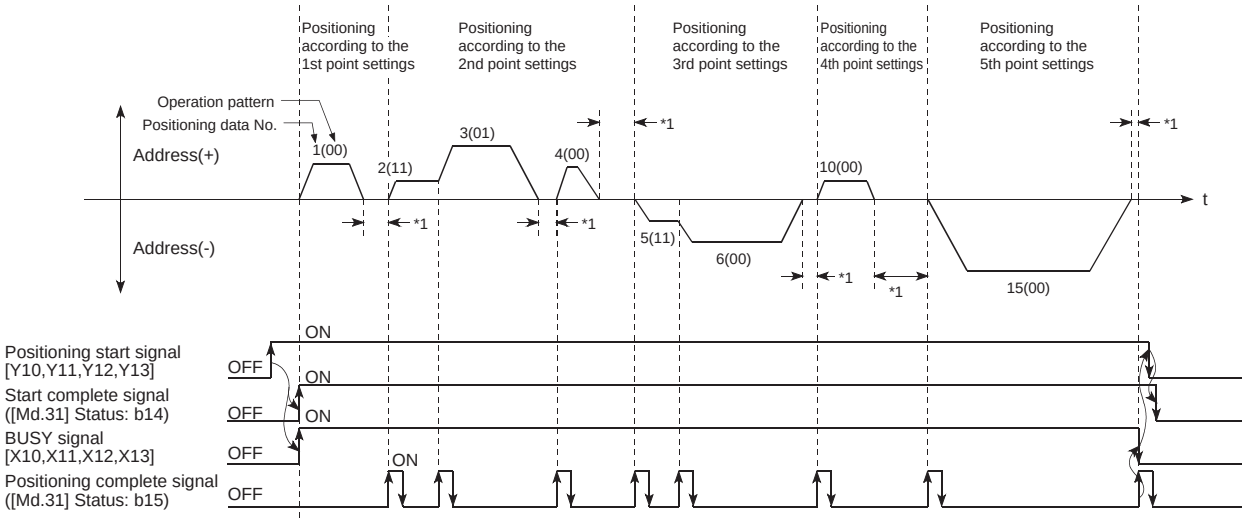
*1 "1 block" is defined as all the data continuing from the positioning data in which "continuous positioning control" or "continuous path control" is set in the "[Da.1] Operation pattern" to the positioning data in which "independent positioning control (Positioning complete)" is set.

## Control examples

The following shows the control executed when the "block start data" of the 1st point of axis 1 is set as shown in the setting examples and started.

- The positioning data is executed in the following order before stopping. Axis 1 positioning data No.1 → 2 → 3 → 4 → 5 → 6 → 10 → 15.

### ■RD77MS4 operation example




*1 Dwell time of corresponding positioning data

# Condition start

In a "condition start", the "condition data" conditional judgment designated in "[Da.14] Parameter" is carried out for the positioning data set in "[Da.12] Start data No.". If the conditions have been established, the "block start data" set in "1: condition start" is executed. If the conditions have not been established, that "block start data" will be ignored, and the "block start data" of the next point will be executed.
The control examples are shown when the "block start data" and "positioning data" are set as shown in the setting examples.

## Setting examples

### ■Block start data setting example

| Axis 1 block start data | [Da.11] Shape | [Da.12] Start data No. | [Da.13] Special start instruction | [Da.14] Parameter |
|---|---|---|---|---|
| 1st point | 1: Continue | 1 | 1: Condition start | 1 |
| 2nd point | 1: Continue | 10 | 1: Condition start | 2 |
| 3rd point | 0: End | 50 | 0: Block start | — |
| ⋮ | | | | |

The "condition data Nos." have been set in "[Da.14] Parameter".

### ■Positioning data setting example

| Axis 1 positioning data No. | [Da.1] Operation pattern |
|---|---|
| 1 | 01: Continuous positioning control |
| 2 | 01: Continuous positioning control |
| 3 | 00: Positioning complete |
| ⋮ | |
| 10 | 11: Continuous path control |
| 11 | 11: Continuous path control |
| 12 | 00: Positioning complete |
| ⋮ | |
| 50 | 00: Positioning complete |
| ⋮ | |

## Control examples

The following shows the control executed when the "block start data" of the 1st point of axis 1 is set as shown in the setting examples and started.

***1.*** The conditional judgment set in "condition data No. 1" is carried out before execution of the axis 1 "positioning data No.1".

→ Conditions established → Execute positioning data No. 1, 2, and 3 → Go to the next 2.

→ Conditions not established → Go to the next 2.

***2.*** The conditional judgment set in "condition data No.2" is carried out before execution of the axis 1 "positioning data No. 10".

→ Conditions established → Execute positioning data No.10, 11, and 12 → Go to the next 3.

→ Conditions not established → Go to the next 3.

***3.*** Execute axis 1 "positioning data No.50" and stop the control.

# Wait start

In a "wait start", the "condition data" conditional judgment designated in "[Da.14] Parameter" is carried out for the positioning data set in "[Da.12] Start data No.". If the conditions have been established, the "block start data" is executed. If the conditions have not been established, the control stops (waits) until the conditions are established.
The control examples are shown when the "block start data" and "positioning data" are set as shown in the setting examples.

## Setting examples

### ■Block start data setting example

| Axis 1 block start data | [Da.11] Shape | [Da.12] Start data No. | [Da.13] Special start instruction | [Da.14] Parameter |
|---|---|---|---|---|
| 1st point | 1: Continue | 1 | 2: Wait start | 3 |
| 2nd point | 1: Continue | 10 | 0: Block start | — |
| 3rd point | 0: End | 50 | 0: Block start | — |
| ⋮ | | | | |

The "condition data Nos." have been set in "[Da.14] Parameter".

### ■Positioning data setting example

| Axis 1 positioning data No. | [Da.1] Operation pattern |
|---|---|
| 1 | 01: Continuous positioning control |
| 2 | 01: Continuous positioning control |
| 3 | 00: Positioning complete |
| ⋮ | |
| 10 | 11: Continuous path control |
| 11 | 11: Continuous path control |
| 12 | 00: Positioning complete |
| ⋮ | |
| 50 | 00: Positioning complete |
| ⋮ | |

## Control examples

The following shows the control executed when the "block start data" of the 1st point of axis 1 is set as shown in the setting examples and started.

***1.*** The conditional judgment set in "condition data No. 3" is carried out before execution of the axis 1 "positioning data No. 1".

→ Conditions established → Execute positioning data No. 1, 2, and 3 → Go to the next 2.

→ Conditions not established → Control stops (waits) until conditions are established → Go to the above 1.

***2.*** Execute the axis 1 "positioning data No. 10, 11, 12, and 50" and stop the control.

# Simultaneous start

In a "simultaneous start", the positioning data set in the "[Da.12] Start data No." and positioning data of other axes set in the "condition data" are simultaneously executed (commands are output with the same timing). (The "condition data" is designated with "[Da.14] Parameter".)
The control examples are shown when the "block start data" and "positioning data" are set as shown in the setting examples.

## Setting examples

### ■Block start data setting example

| Axis 1 block start data | [Da.11] Shape | [Da.12] Start data No. | [Da.13] Special start instruction | [Da.14] Parameter |
|---|---|---|---|---|
| 1st point | 0: End | 1 | 3: Simultaneous start | 4 |
| ⋮ | | | | |

It is assumed that the "axis 2 positioning data" for simultaneous starting is set in the "condition data" designated with "[Da.14] Parameter".

### ■Positioning data setting example

| Axis 1 positioning data No. | [Da.1] Operation pattern |
|---|---|
| 1 | 01: Continuous positioning control |
| 2 | 01: Continuous positioning control |
| 3 | 00: Positioning complete |
| ⋮ | |

## Control examples

The following shows the control executed when the "block start data" of the 1st point of axis 1 is set as shown in the setting examples and started.

***1.*** Check the axis operation status of axis 2 which is regarded as the simultaneously started axis.
→ Axis 2 is standing by → Go to the next 2.
→ Axis 2 is carrying out positioning. → An error occurs and simultaneous start will not be carried out.

***2.*** Simultaneously start the axis 1 "positioning data No. 1" and axis 2 positioning data set in "condition data No. 4.

## Precautions

Positioning data No. executed by simultaneously started axes is set to condition data ("[Da.18] Parameter 1", "[Da.19] Parameter 2"), but the setting value of start axis (the axis which carries out positioning start) should be "0". If the setting value is set to other than "0", the positioning data set in "[Da.18] Parameter 1", "[Da.19] Parameter 2" is given priority to be executed rather than "[Da.12] Start data No.".
For details, refer to the following.
☞ Page 463 Condition Data

# Repeated start (FOR loop)

In a "repeated start (FOR loop)", the data between the "block start data" in which "4: FOR loop" is set in "[Da.13] Special start instruction" and the "block start data" in which "6: NEXT start" is set in "[Da.13] Special start instruction " is repeatedly executed for the number of times set in "[Da.14] Parameter". An endless loop will result if the number of repetitions is set to "0".
(The number of repetitions is set in "[Da.14] Parameter" of the "block start data" in which "4: FOR loop" is set in "[Da.13] Special start instruction".)
The control examples are shown when the "block start data" and "positioning data" are set as shown in the setting examples.



## Setting examples

### ■Block start data setting example

| Axis 1 block start data | [Da.11] Shape | [Da.12] Start data No. | [Da.13] Special start instruction | [Da.14] Parameter |
|---|---|---|---|---|
| 1st point | 1: Continue | 1 | 4: FOR loop | 2 |
| 2nd point | 1: Continue | 10 | 0: Block start | — |
| 3rd point | 0: End | 50 | 6: NEXT start | — |
| ⋮ | | | | |

The "condition data Nos." have been set in "[Da.14] Parameter".

### ■Positioning data setting example

| Axis 1 positioning data No. | [Da.1] Operation pattern |
|---|---|
| 1 | 01: Continuous positioning control |
| 2 | 01: Continuous positioning control |
| 3 | 00: Positioning complete |
| ⋮ | |
| 10 | 11: Continuous path control |
| 11 | 00: Positioning complete |
| ⋮ | |
| 50 | 01: Continuous positioning control |
| 51 | 00: Positioning complete |
| ⋮ | |

## Control examples

The following shows the control executed when the "block start data" of the 1st point of axis 1 is set as shown in the setting examples and started.

1. Execute the axis 1 "positioning data No.1, 2, 3, 10, 11, 50, and 51".
2. Return to the axis 1 "1st point block start data". Again execute the axis 1 "positioning data No.1, 2, 3, 10, 11, 50 and 51", and then stop the control. (Repeat for the number of times (2 times) set in [Da.14].)

# Repeated start (FOR condition)

In a "repeated start (FOR condition)", the data between the "block start data" in which "5: FOR condition" is set in "[Da.13] Special start instruction" and the "block start data" in which "6: NEXT start" is set in "[Da.13] Special start instruction" is repeatedly executed until the establishment of the conditions set in the "condition data".
Conditional judgment is carried out as soon as switching to the point of "6: NEXT start" (before positioning of NEXT start point).
(The "condition data" designation is set in "[Da.14] Parameter" of the "block start data" in which "5: FOR condition" is set in "[Da.13] Special start instruction".)
The control examples are shown when the "block start data" and "positioning data" are set as shown in the setting examples.

## Setting examples

### ■Block start data setting example

| Axis 1 block start data | [Da.11] Shape | [Da.12] Start data No. | [Da.13] Special start instruction | [Da.14] Parameter |
|---|---|---|---|---|
| 1st point | 1: Continue | 1 | 5: FOR condition | 5 |
| 2nd point | 1: Continue | 10 | 0: Block start | — |
| 3rd point | 0: End | 50 | 6: NEXT start | — |
| ⋮ | | | | |

The "condition data Nos." have been set in "[Da.14] Parameter".

### ■Positioning data setting example

| Axis 1 positioning data No. | [Da.1] Operation pattern |
|---|---|
| 1 | 01: Continuous positioning control |
| 2 | 01: Continuous positioning control |
| 3 | 00: Positioning complete |
| ⋮ | |
| 10 | 11: Continuous path control |
| 11 | 00: Positioning complete |
| ⋮ | |
| 50 | 01: Continuous positioning control |
| 51 | 00: Positioning complete |
| ⋮ | |

## Control examples

The following shows the control executed when the "block start data" of the 1st point of axis 1 is set as shown in the setting examples and started.

***1.*** Execute the axis 1 "positioning data No.1, 2, 3, 10, and 11".

***2.*** Carry out the conditional judgment set in axis 1 "condition data No.5".*1

→ Conditions not established → Execute "Positioning data No.50, 51". Go to the above 1.

→ Conditions established → Execute "Positioning data No.50, 51" and complete the positioning.

*1 Conditional judgment is carried out as soon as switching to NEXT start point (before positioning of NEXT start point).

# Restrictions when using the NEXT start

The "NEXT start" is an instruction indicating the end of the repetitions when executing the repeated start (FOR loop) and the repeated start (FOR condition).

(☞ Page 153 Repeated start (FOR loop), Page 154 Repeated start (FOR condition))

The following shows the restrictions when setting "6: NEXT start" in the "block start data".

- The processing when "6: NEXT start" is set before execution of "4: FOR loop" or "5: FOR condition" is the same as that for a "0: block start".
- Repeated processing will not be carried out if there is no "6: NEXT start" instruction after the "4: FOR loop" or "5: FOR condition" instruction. (Note that an "error" will not occur.)
- Nesting is not possible between "4: FOR loop" and "6: NEXT start", or between "5: FOR condition" and "6: NEXT start". The warning "FOR to NEXT nest construction" (warning code: 09F1H) will occur if nesting is attempted.

[Operating examples without nesting structure]

| Start block data | [Da.13] Special start instruction |
|---|---|
| 1st point | Normal start |
| 2nd point | FOR |
| 3rd point | Normal start |
| 4th point | NEXT → FOR of the 2nd point |
| 5th point | Normal start |
| 6th point | Normal start |
| 7th point | FOR |
| 8th point | Normal start |
| 9th point | NEXT → FOR of the 7th point |
| ⋮ | |

[Operating examples with nesting structure]

| Start block data | [Da.13] Special start instruction |
|---|---|
| 1st point | Normal start |
| 2nd point | FOR |
| 3rd point | Normal start |
| 4th point | FOR |
| 5th point | Normal start |
| 6th point | Normal start |
| 7th point | NEXT → FOR of the 4th point |
| 8th point | Normal start |
| 9th point | NEXT |
| ⋮ | |

A warning will occur when starting the 4th point "FOR". The JUMP destination of the 7th point "NEXT" is the 4th point. The 9th point "NEXT" is processed as normal start.

# 4.4 Setting the Condition Data

## Relation between various controls and the condition data

"Condition data" is set in the following cases.

- When setting conditions during execution of JUMP instruction (major positioning control)
- When setting conditions during execution of "high-level positioning control"

The "condition data" to be set includes the setting items from [Da.15] to [Da.19] and [Da.23] to [Da.26], but the setting requirements and details differ according to the control method and setting conditions.

The following shows the "condition data" "[Da.15] Condition target" corresponding to the different types of control.

(The "condition data" settings in this chapter are assumed to be carried out using the engineering tool.)

◎: One of the setting items must be set.

×: Setting not possible

| [Da.15] Setting item | High-level positioning control | | | | Major positioning control |
|---|---|---|---|---|---|
| | Block start | Wait start | Simultaneous start | Repeated start (For condition) | JUMP instruction |
| 01: Device X*1 | ◎ | ◎ | × | ◎ | ◎ |
| 02: Device Y*1 | ◎ | ◎ | × | ◎ | ◎ |
| 03: Buffer memory (1 word) | ◎ | ◎ | × | ◎ | ◎ |
| 04: Buffer memory (2 words) | ◎ | ◎ | × | ◎ | ◎ |
| 05: Positioning data No. | × | × | ◎ | × | × |

*1 Refer to devices X/Y which belongs to Simple Motion module.

**Restriction**

It is recommended that the "condition data" be set whenever possible with the engineering tool. Execution by a program uses many programs and devices. The execution becomes complicated, and the scan times will increase.

The setting requirements and details of the following "condition data" [Da.16] to [Da.19] and [Da.23] setting items differ according to the "[Da.15] Condition target" setting.

The following shows the [Da.16] to [Da.19] and [Da.23] setting items corresponding to the "[Da.15] Condition target".

—: Setting not required (The setting value is invalid. Set the initial value or a value within the setting range.)

**: Value stored in buffer memory designated in [Da.17]

| [Da.15] Condition target | [Da.16] Condition operator | [Da.23] Number of simultaneously starting axes | [Da.17] Address | [Da.18] Parameter 1 | [Da.19] Parameter 2 |
|---|---|---|---|---|---|
| 01H: Device X | 07H: DEV = ON<br>08H: DEV = OFF | — | — | 0 to 1FH (bit No.) | — |
| 02H: Device Y | | | | 0 to 1FH (bit No.) | |
| 03H: Buffer memory (1 word)*1 | 01H: ** = P1<br>02H: ** ≠ P1<br>03H: ** ≤ P1<br>04H: ** ≥ P1<br>05H: P1 ≤ ** ≤ P2<br>06H: ** ≤ P1, P2 ≤ ** | | Buffer memory address | P1 (numeric value) | P2 (numeric value)<br>(Set only when "[Da.16]" is [05H] or [06H].) |
| 04H: Buffer memory (2 words)*1 | | | | | |
| 05H: Positioning data No. | Setting not possible | 2 | — | Low-order 16 bits: "[Da.24] Simultaneously starting axis No.1" positioning data No.<br>High-order 16 bits: "[Da.25] Simultaneously starting axis No.2" positioning data No. | — |
| | | 3 | | | Low-order 16 bits: "[Da.26] Simultaneously starting axis No.3" positioning data No.<br>High-order 16 bits: Unusable (Set "0".) |
| | | 4 | | | |

*1 Comparison of ≤ and ≥ is judged as signed values. (☞ Page 466 [Da.16] Condition operator)

## Judgment whether the condition operator is "=" or "≠" at the start of wait.

Judgment on data is carried out for each operation cycle of the Simple Motion module. Thus, in the judgment on the data such as current feed value which varies continuously, the operator "=" may not be detected. If this occurs, use a range operator.

**Point**

The "PLC CPU memo area" can be designated as the buffer memory address to be designated in [Da.17].

# Condition data setting examples

The following shows the setting examples for "condition data".

## Setting the device ON/OFF as a condition

[Condition]

Device "X10" (Axis 1 BUSY signal) is OFF

| [Da.15] Condition target | [Da.16] Condition operator | [Da.17] Address | [Da.18] Parameter 1 | [Da.19] Parameter 2 | [Da.23] Number of simultaneously starting axes | [Da.24] Simultaneously starting axis No.1 | [Da.25] Simultaneously starting axis No.2 | [Da.26] Simultaneously starting axis No.3 |
|---|---|---|---|---|---|---|---|---|
| 01H: Device X | 08H: DEV = OFF | — | 10H | — | — | — | — | — |

## Setting the numeric value stored in the "buffer memory" as a condition

[Condition]

The value stored in buffer memory addresses "2400, 2401" ([Md.20] Current feed value) is "1000" or larger.

| [Da.15] Condition target | [Da.16] Condition operator | [Da.17] Address | [Da.18] Parameter 1 | [Da.19] Parameter 2 | [Da.23] Number of simultaneously starting axes | [Da.24] Simultaneously starting axis No.1 | [Da.25] Simultaneously starting axis No.2 | [Da.26] Simultaneously starting axis No.3 |
|---|---|---|---|---|---|---|---|---|
| 04H: Buffer memory (2 words) | 04H: ** ≥ P1 | 2400 | 1000 | — | — | — | — | — |

## Designating the axis and positioning data No.*1

*1 The axis and positioning data No. are to be simultaneously started in "simultaneous start".

[Condition]

Simultaneously starting "axis 2 positioning data No.3"

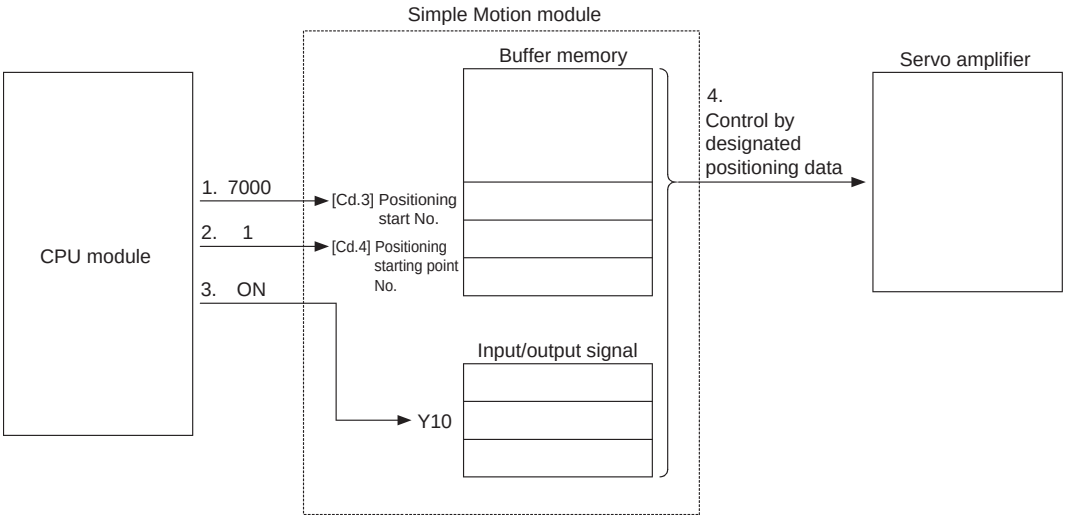
| [Da.15] Condition target | [Da.16] Condition operator | [Da.17] Address | [Da.18] Parameter 1 | [Da.19] Parameter 2 | [Da.23] Number of simultaneously starting axes | [Da.24] Simultaneously starting axis No.1 | [Da.25] Simultaneously starting axis No.2 | [Da.26] Simultaneously starting axis No.3 |
|---|---|---|---|---|---|---|---|---|
| 05H: Positioning data No. | — | — | Low-order 16 bits "0003H" | — | 2H: 2 axes | 1H: Axis 2 | 0H | 0H |

# 4.5 Start Program for High-level Positioning Control

## Starting high-level positioning control

To execute high-level positioning control, a program must be created to start the control in the same method as for major positioning control.

The following shows the procedure for starting the "1st point block start data" (regarded as block No. 7000) set in axis 1.




*1 When carrying out a positioning start with the next scan after a positioning operation is completed, turn the Y10 signal OFF and input the start complete signal ([Md.31] Status: b14) as an interlock condition to start after the start complete signal ([Md.31] Status: b14) is turned OFF.

***1.*** Set "7000" in "[Cd.3] Positioning start No.".

(This establishes that the control as "high-level positioning control" using block start data.)

***2.*** Set the point No. of the "block start data" to be started. (In this case "1".)

***3.*** Turn ON the start signal.

***4.*** The positioning data set in the "1st point block start data" is started.

# Example of a start program for high-level positioning control

The following shows an example of a start program for high-level positioning control in which the 1st point "block start data" of axis 1 is started. (The block No. is regarded as "7000".)

## Control data that require setting

The following control data must be set to execute high-level positioning control. The setting is carried out using a program.
n: Axis No. - 1

| Setting item | | Setting value | Setting details | Buffer memory address |
|---|---|---|---|---|
| [Cd.3] | Positioning start No. | 7000 | Set "7000" to indicate control using "block start data". | 4300+100n |
| [Cd.4] | Positioning starting point No. | 1 | Set the point No. of the "block start data" to be started. | 4301+100n |

Refer to the followings for details on the setting details.
☞ Page 504 Control Data

## Start conditions

The following conditions must be fulfilled when starting the control. The required conditions must also be integrated into the program, and configured so the control does not start unless the conditions are fulfilled.

| Signal name | | Signal state | | Device |
|---|---|---|---|---|
| Interface signal | PLC READY signal | ON | CPU module preparation completed | Y0 |
| | READY signal | ON | RD77MS preparation completed | X0 |
| | All axis servo ON | ON | All axis servo ON | Y1 |
| | Synchronization flag | ON | The RD77MS buffer memory can be accessed. | X1 |
| | Axis stop signal | OFF | Axis stop signal is OFF | [Cd.180] Axis stop |
| | Start complete signal | OFF | Start complete signal is OFF | [Md.31] Status: b14 |
| | BUSY signal | OFF | BUSY signal is OFF | X10 to X1F |
| | Error detection signal | OFF | There is no error | [Md.31] Status: b13 |
| | M code ON signal | OFF | M code ON signal is OFF | [Md.31] Status: b12 |
| External signal | Forced stop input signal | ON | There is no forced stop input | — |
| | Stop signal | OFF | Stop signal is OFF | — |
| | Upper limit (FLS) | ON | Within limit range | — |
| | Lower limit (RLS) | ON | Within limit range | — |

## Start time chart

The following chart shows a time chart in which the positioning data No. 1, 2, 10, 11, and 12 of the axis 1 are continuously executed as an example.

### ■Block start data setting example

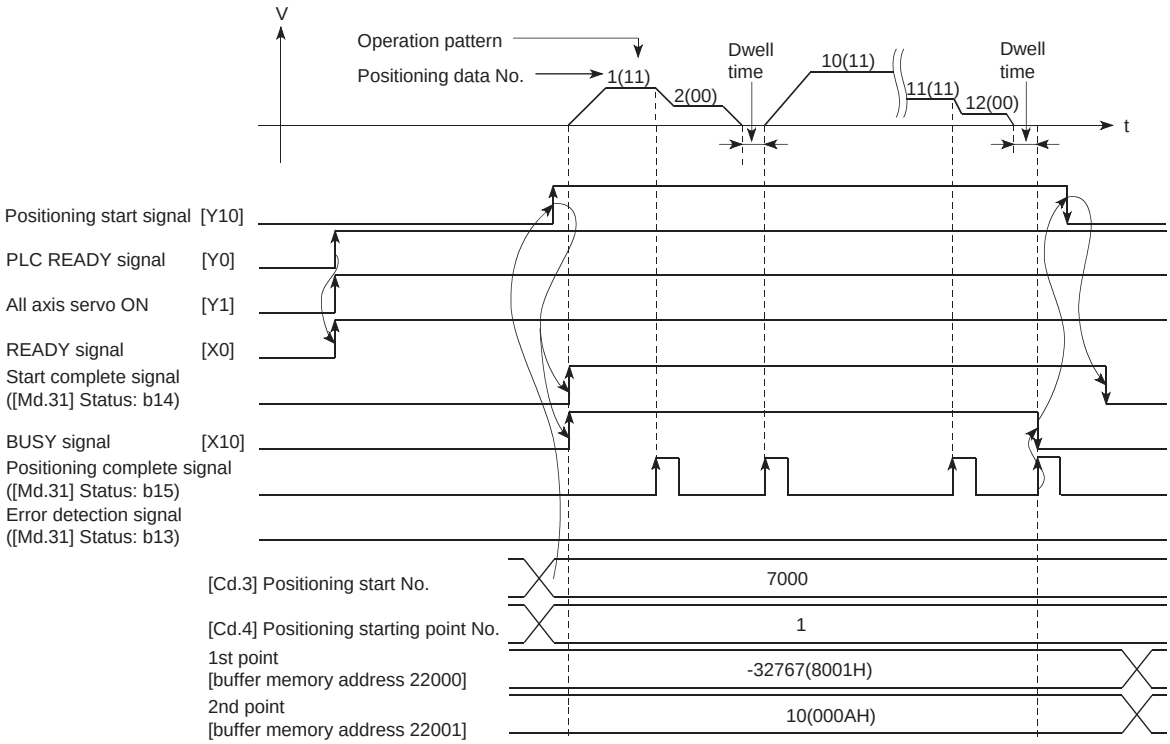
| Axis 1 block start data | [Da.11] Shape | [Da.12] Start data No. | [Da.13] Special start instruction | [Da.14] Parameter |
|---|---|---|---|---|
| 1st point | 1: Continue | 1 | 0: Block start | — |
| 2nd point | 0: End | 10 | 0: Block start | — |
| ⋮ | | | | |

### ■Positioning data setting example

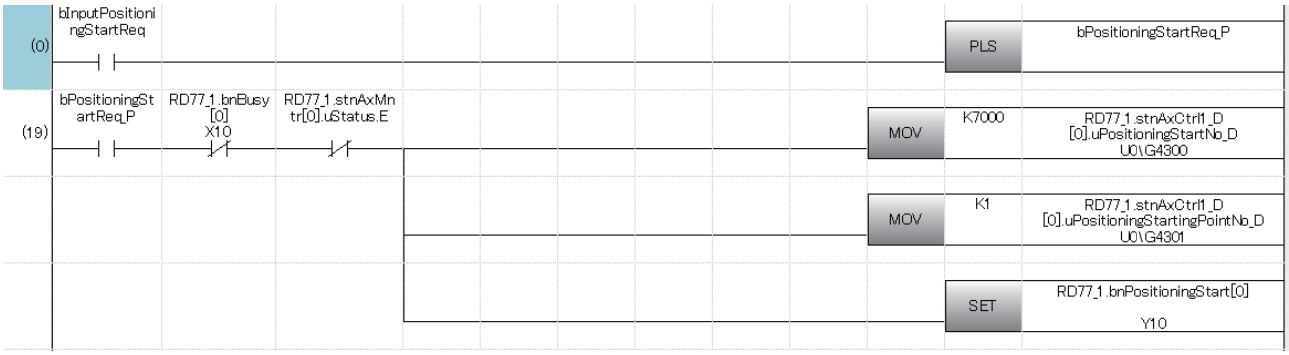
| Axis 1 positioning data No. | [Da.1] Operation pattern |
|---|---|
| 1 | 11: Continuous path control |
| 2 | 00: Positioning complete |
| ⋮ | |
| 10 | 11: Continuous path control |
| 11 | 11: Continuous path control |
| 12 | 00: Positioning complete |
| ⋮ | |

### ■Start time chart

[RD77MS4 operation example]



## Program example




| Classification | Label name | Description |
|---|---|---|
| Module label | RD77_1.bnBusy[0] | Axis 1 BUSY signal |
| | RD77_1.stnAxMntr[0].uStatus.E | Axis 1 Positioning complete |
| | RD77_1.stnAxCtrl1_D[0].uPositioningStartNo_D | Axis 1 Positioning start No. |
| | RD77_1.stnAxCtrl1_D[0].uPositioningStartingPointNo_D | Axis 1 Positioning starting point No. |
| | RD77_1.bnPositioningStart[0] | Axis 1 Positioning start |
| Global label, local label | Defines the global label or the local label as follows. The settings of Assign (Device/Label) are not required for the label that the assignment device is not set because the unused internal relay and data device are automatically assigned. | |

| | Label Name | Data Type | | Class |
|---|---|---|---|---|
| 1 | bPositioningStartReq_P | Bit | ... | VAR |
| 2 | bInputPositioningStartReq | Bit | ... | VAR |
| 3 | | | ... | |

# 5 MANUAL CONTROL

The details and usage of manual control are explained in this chapter.
In manual control, commands are issued during a JOG operation and an inching operation executed by the turning ON of the JOG start signal, or from a manual pulse generator connected to the Simple Motion module.
Manual control using a program from the CPU module is explained in this chapter.

## 5.1 Outline of Manual Control

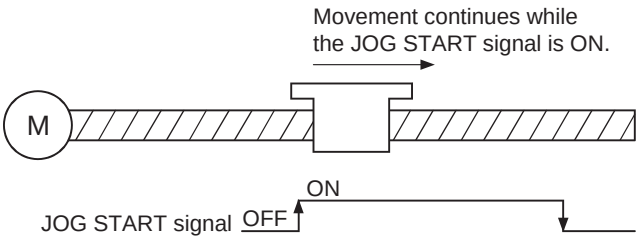
### Three manual control methods

"Manual control" refers to control in which positioning data is not used, and a positioning operation is carried out in response to signal input from an external device.
The three types of this "manual control" are explained below.



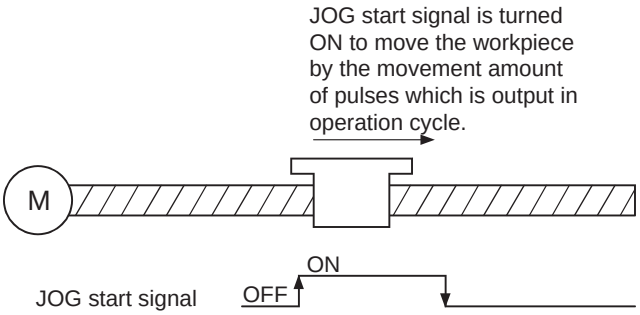
#### JOG operation

"JOG operation" is a control method in which the machine is moved by only a movement amount (commands are continuously output while the JOG START signal is ON). This operation is used to move the workpiece in the direction in which the limit signal is ON, when the operation is stopped by turning the limit signal OFF to confirm the positioning system connection and obtain the positioning data address (☞ Page 285 Teaching function).



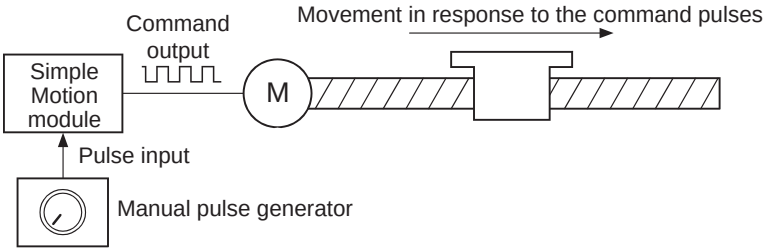

#### Inching operation

"Inching operation" is a control method in which a minute movement amount of command is output manually in operation cycle. When the "inching movement amount" of the axis control data is set by JOG operation, the workpiece is moved by a set movement amount. (When the "inching movement amount" is set to "0", the machine operates as JOG operation.)



## Manual pulse generator operation

"Manual pulse generator operation" is a control method in which positioning is carried out in response to the number of pulses input from a manual pulse generator (the number of input command is output). This operation is used for manual fine adjustment, etc., when carrying out accurate positioning to obtain the positioning address.




### ■Manual control sub functions

Refer to the following for details on "sub functions" that can be combined with manual control.

📖MELSEC iQ-R Simple Motion Module User's Manual (Startup)

Also refer to the following for details on each sub function.

☞ Page 215 CONTROL SUB FUNCTIONS

### ■Monitoring manual control

Refer to the following for directly monitoring the buffer memory using an engineering tool.

☞ Page 468 Monitor Data

Also refer to the "Simple Motion Module Setting Function Help" when monitoring with the monitor functions of an engineering tool.

# 5.2 JOG Operation

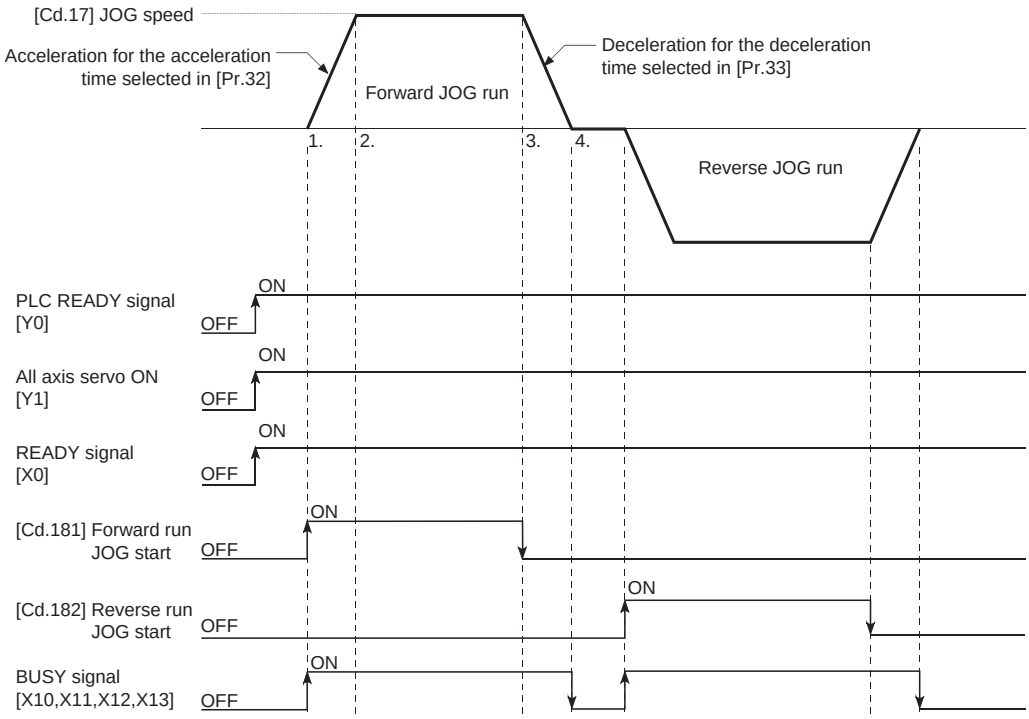
## Outline of JOG operation

### Operation

In JOG operation, the forward run JOG start signal [Cd.181] or reverse run JOG start signal [Cd.182] turns ON, causing pulses to be output to the servo amplifier from the Simple Motion module while the signal is ON. The workpiece is then moved in the designated direction.
The following shows examples of JOG operation.

#### ■RD77MS4 operation example

1. When the START signal turns ON, acceleration begins in the direction designated by the START signal, and continues for the acceleration time designated in "[Pr.32] JOG operation acceleration time selection". At this time, the BUSY signal changes from OFF to ON.
2. When the workpiece being accelerated reaches the speed set in "[Cd.17] JOG speed", the movement continues at this speed. The constant speed movement takes place at 2. and 3.
3. When the START signal is turned OFF, deceleration begins from the speed set in "[Cd.17] JOG speed", and continues for the deceleration time designated in "[Pr.33] JOG operation deceleration time selection".
4. The operation stops when the speed becomes "0". At this time, the BUSY signal changes from ON to OFF.




**Restriction**

Use the hardware stroke limit function when carrying out JOG operation near the upper or lower limits.
(☞ Page 243 Hardware stroke limit function)
If the hardware stroke limit function is not used, the workpiece may exceed the moving range, causing an accident.

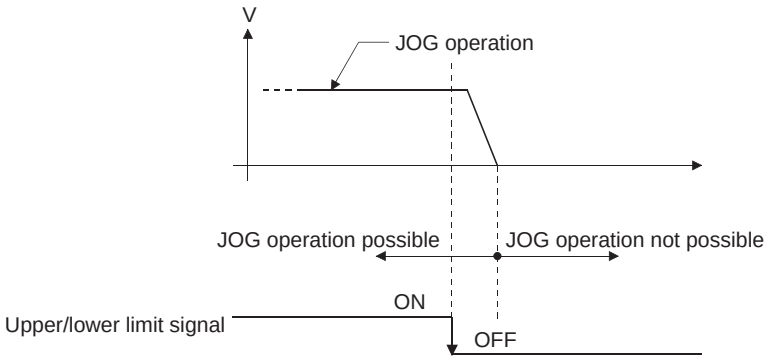
## Precautions during operation

The following details must be understood before carrying out JOG operation.

- For safety, set a small value to "[Cd.17] JOG speed" at first and check the movement. Then gradually increase the value.
- The error "Outside JOG speed range" (error code: 1980H) will occur and the operation will not start if the "JOG speed" is outside the setting range at the JOG start.
- The error "JOG speed limit value error" (error code: 1AB7H, 1AB8H) will occur and the operation will not start if "[Pr.31] JOG speed limit value" is set to a value larger than "[Pr.8] Speed limit value".
- If "[Cd.17] JOG speed" exceeds the speed set in "[Pr.31] JOG speed limit value", the workpiece will move at the "[Pr.31] JOG speed limit value" and the warning "JOG speed limit value" (warning code: 0981H, 0982H) will occur in the Simple Motion module.
- The JOG operation can be continued even if an "Axis warning" has occurred.
- Set a "0" in "[Cd.16] Inching movement amount". If a value other than "0" is set, the operation will become an inching operation. (☞ Page 174 Inching Operation)

## Operations when stroke limit error occurs

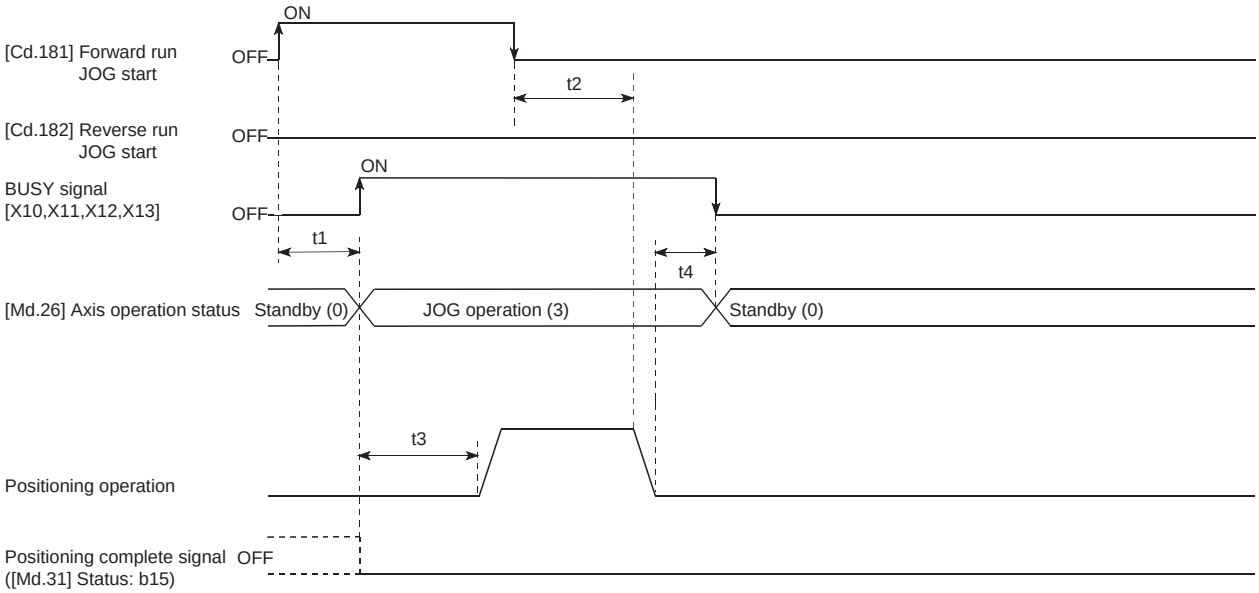
When the operation is stopped by hardware stroke limit error or software stroke limit error, the JOG operation can execute in an opposite way (direction within normal limits) after an error reset. (An error will occur again if JOG start signal is turned ON in a direction to outside the stroke limit.)




## Operation timing and processing time

The following drawing shows details of the JOG operation timing and processing time.

### ■RD77MS4 operation example



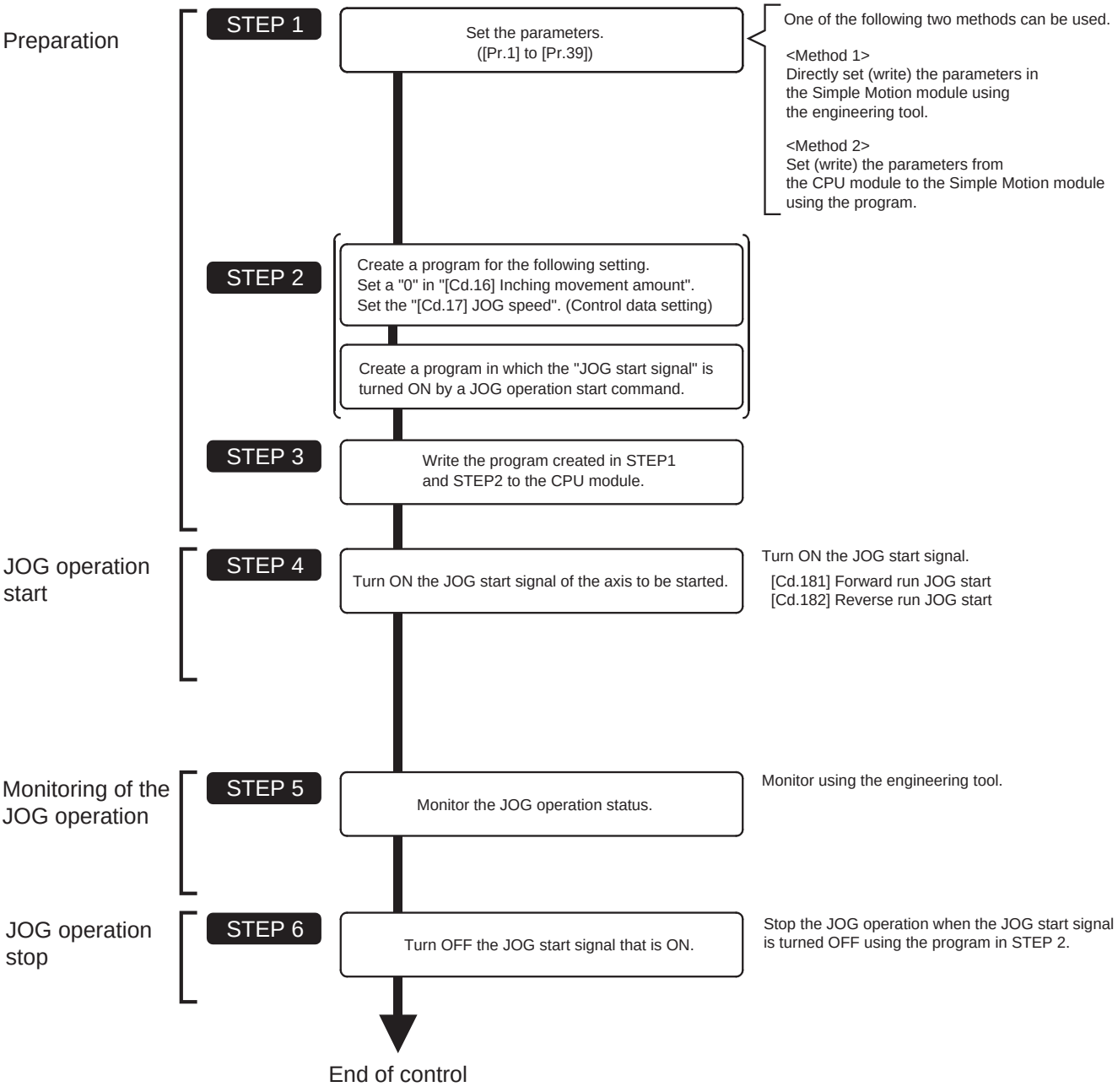
Normal timing time (Unit: [ms])

| Operation cycle | t1*1 | t2 | t3 | t4 |
|---|---|---|---|---|
| 0.444 | 0.267 to 2.584 | 0.000 to 0.444 | 1.128 to 1.699 | 0.000 to 0.444 |
| 0.888 | 0.267 to 2.584 | 0.000 to 0.888 | 2.328 to 3.036 | 0.000 to 0.888 |
| 1.777 | 0.267 to 2.584 | 0.000 to 1.777 | 4.520 to 4.590 | 0.000 to 1.777 |
| 3.555 | 0.267 to 2.584 | 0.000 to 3.555 | 8.064 to 8.120 | 0.000 to 3.555 |

*1 Delays may occur in the t1 timing time due to the operation status of other axes.

# JOG operation execution procedure

The JOG operation is carried out by the following procedure.


Preparation
STEP 1
Set the parameters.
([Pr.1] to [Pr.39])
One of the following two methods can be used.
<Method 1>
Directly set (write) the parameters in the Simple Motion module using the engineering tool.
<Method 2>
Set (write) the parameters from the CPU module to the Simple Motion module using the program.
STEP 2
Create a program for the following setting.
Set a "0" in "[Cd.16] Inching movement amount".
Set the "[Cd.17] JOG speed". (Control data setting)
Create a program in which the "JOG start signal" is turned ON by a JOG operation start command.
STEP 3
Write the program created in STEP1 and STEP2 to the CPU module.
JOG operation start
STEP 4
Turn ON the JOG start signal of the axis to be started.
Turn ON the JOG start signal.
[Cd.181] Forward run JOG start
[Cd.182] Reverse run JOG start
Monitoring of the JOG operation
STEP 5
Monitor the JOG operation status.
Monitor using the engineering tool.
JOG operation stop
STEP 6
Turn OFF the JOG start signal that is ON.
Stop the JOG operation when the JOG start signal is turned OFF using the program in STEP 2.
End of control

**Point**

- Mechanical elements such as limit switches are considered as already installed.
- Parameter settings work in common for all control using the Simple Motion module.

# Setting the required parameters for JOG operation

The "Positioning parameters" must be set to carry out JOG operation.

The following table shows the setting items of the required parameters for carrying out JOG operation. Parameters not shown below are not required to be set for carrying out only JOG operation. (Set the initial value or a value within the setting range.)

◎: Setting always required.

○: Set according to requirements (Set the initial value or a value within the setting range when not used.)

| Setting item | | | Setting requirement |
|---|---|---|---|
| Positioning parameters | [Pr.1] | Unit setting | ◎ |
| | [Pr.2] | Number of pulses per rotation (AP) (Unit: pulse) | ◎ |
| | [Pr.3] | Movement amount per rotation (AL) (Unit: pulse) | ◎ |
| | [Pr.4] | Unit magnification (AM) | ◎ |
| | [Pr.7] | Bias speed at start (Unit: pulse/s) | ○ |
| | [Pr.8] | Speed limit value (Unit: pulse/s) | ◎ |
| | [Pr.9] | Acceleration time 0 (Unit: ms) | ◎ |
| | [Pr.10] | Deceleration time 0 (Unit: ms) | ◎ |
| | [Pr.11] | Backlash compensation amount (Unit: pulse) | ○ |
| | [Pr.12] | Software stroke limit upper limit value (Unit: pulse) | ○ |
| | [Pr.13] | Software stroke limit lower limit value (Unit: pulse) | ○ |
| | [Pr.14] | Software stroke limit selection | ○ |
| | [Pr.15] | Software stroke limit valid/invalid setting | ○ |
| | [Pr.17] | Torque limit setting value (Unit: 0.1%) | ○ |
| | [Pr.25] | Acceleration time 1 (Unit: ms) | ○ |
| | [Pr.26] | Acceleration time 2 (Unit: ms) | ○ |
| | [Pr.27] | Acceleration time 3 (Unit: ms) | ○ |
| | [Pr.28] | Deceleration time 1 (Unit: ms) | ○ |
| | [Pr.29] | Deceleration time 2 (Unit: ms) | ○ |
| | [Pr.30] | Deceleration time 3 (Unit: ms) | ○ |
| | [Pr.31] | JOG speed limit value (Unit: pulse/s) | ◎ |
| | [Pr.32] | JOG operation acceleration time selection | ◎ |
| | [Pr.33] | JOG operation deceleration time selection | ◎ |
| | [Pr.34] | Acceleration/deceleration process selection | ○ |
| | [Pr.35] | S-curve ratio (Unit: %) | ○ |
| | [Pr.36] | Sudden stop deceleration time (Unit: ms) | ○ |
| | [Pr.37] | Stop group 1 sudden stop selection | ○ |
| | [Pr.38] | Stop group 2 sudden stop selection | ○ |
| | [Pr.39] | Stop group 3 sudden stop selection | ○ |

Refer to the following for the setting details.

☞ Page 407 Basic Setting

**Point**

- Parameter settings work in common for all controls using the Simple Motion module. When carrying out other controls ("major positioning control", "high-level positioning control", "home position return positioning control"), set the respective setting items as well.
- Parameters are set for each axis.

# Creating start programs for JOG operation

A program must be created to execute a JOG operation. Consider the "required control data setting", "start conditions" and "start time chart" when creating the program.
The following shows an example when a JOG operation is started for axis 1. ("[Cd.17] JOG speed" is set to "100.00 mm/min" in the example shown.)

## Required control data setting

The control data shown below must be set to execute a JOG operation. The setting is carried out with the program.
n: Axis No. - 1

| Setting item | | Setting value | Setting details | Buffer memory address |
|---|---|---|---|---|
| [Cd.16] | Inching movement amount | 0 | Set "0". | 4317+100n |
| [Cd.17] | JOG speed | 10000 | Set a value equal to or below the "[Pr.31] JOG speed limit value". | 4318+100n<br>4319+100n |

Refer to the followings for the setting details.
☞ Page 504 Control Data

## Start conditions

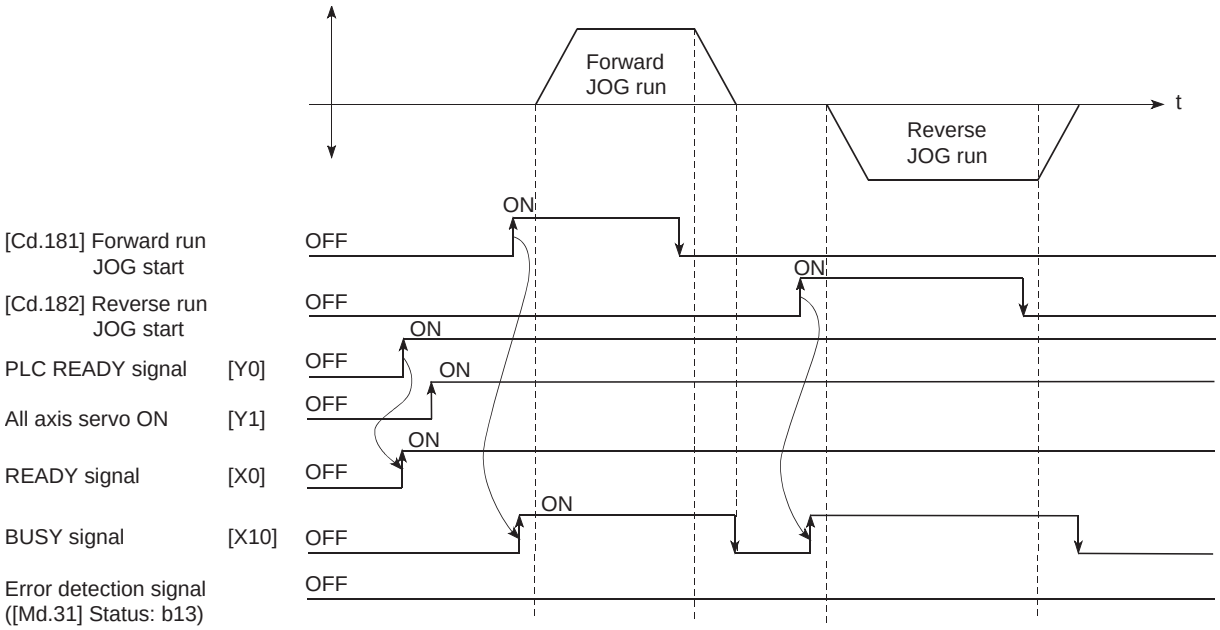
The following conditions must be fulfilled when starting. The required conditions must also be assembled in the program, and the program must be configured so the operation will not start if the conditions are not fulfilled.

| Signal name | | Signal state | | Device |
|---|---|---|---|---|
| Interface signal | PLC READY signal | ON | CPU module preparation completed | Y0 |
| | READY signal | ON | RD77MS preparation completed | X0 |
| | All axis servo ON | ON | All axis servo ON | Y1 |
| | Synchronization flag*1 | ON | The RD77MS buffer memory can be accessed. | X1 |
| | Axis stop signal | OFF | Axis stop signal is OFF | [Cd.180] Axis stop |
| | Start complete signal | OFF | Start complete signal is OFF | [Md.31] Status: b14 |
| | BUSY signal | OFF | RD77MS is not operating | X10 to X1F |
| | Error detection signal | OFF | There is no error | [Md.31] Status: b13 |
| | M code ON signal | OFF | M code ON signal is OFF | [Md.31] Status: b12 |
| External signal | Forced stop input signal | ON | There is no forced stop input | — |
| | Stop signal | OFF | Stop signal is OFF | — |
| | Upper limit (FLS) | ON | Within limit range | — |
| | Lower limit (RLS) | ON | Within limit range | — |

*1 The interlock must be provided so that the buffer memory is accessed after Synchronization flag [X1] turns on. When no interlock is provided, an unexpected value may be read or written.

## Start time chart

### ■RD77MS4 operation example




## Program example

Refer to the followings for the program example of the JOG operation.

☞ Page 567 JOG operation setting program

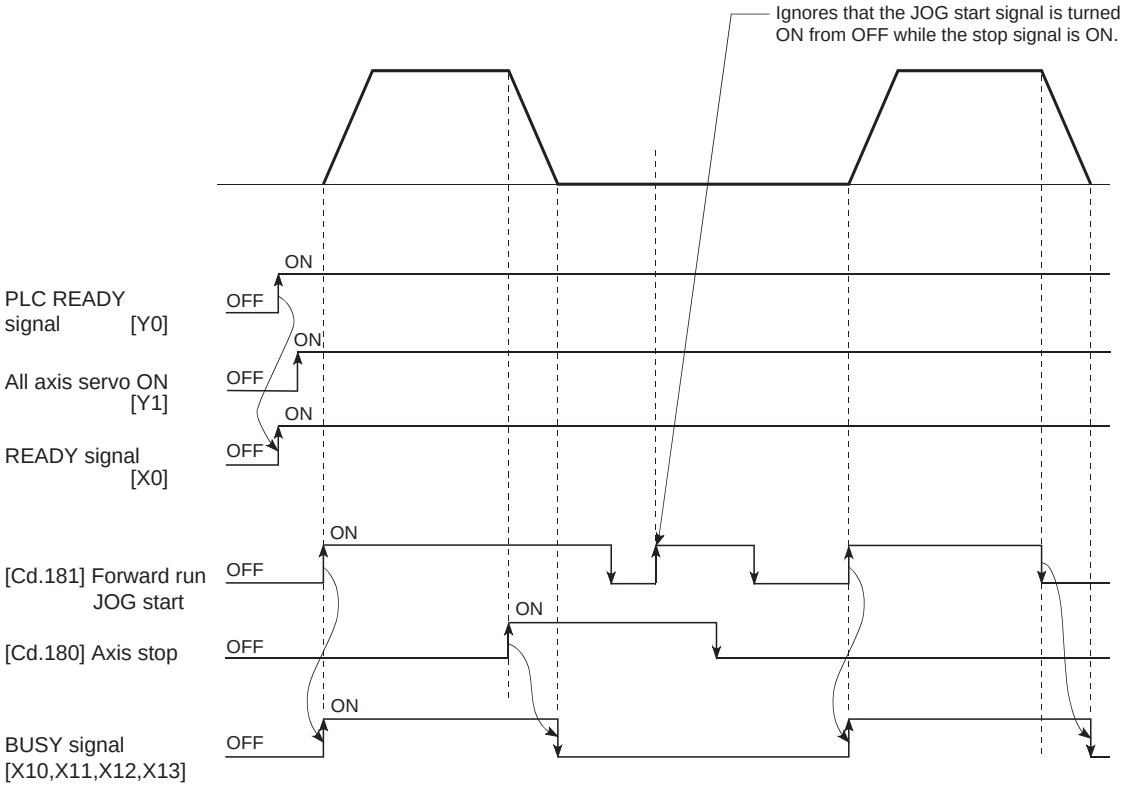
☞ Page 568 JOG operation/inching operation execution program

# JOG operation example

## Example 1

When the "stop signal" is turned ON during JOG operation, the JOG operation will stop by the "deceleration stop" method.
If the JOG start signal is turned ON while the stop signal is ON, the error "Stop signal ON at start" (error code: 1908H) will occur.
The inching operation can be re-started when the stop signal is turned OFF and the JOG start signal is turned ON from OFF.

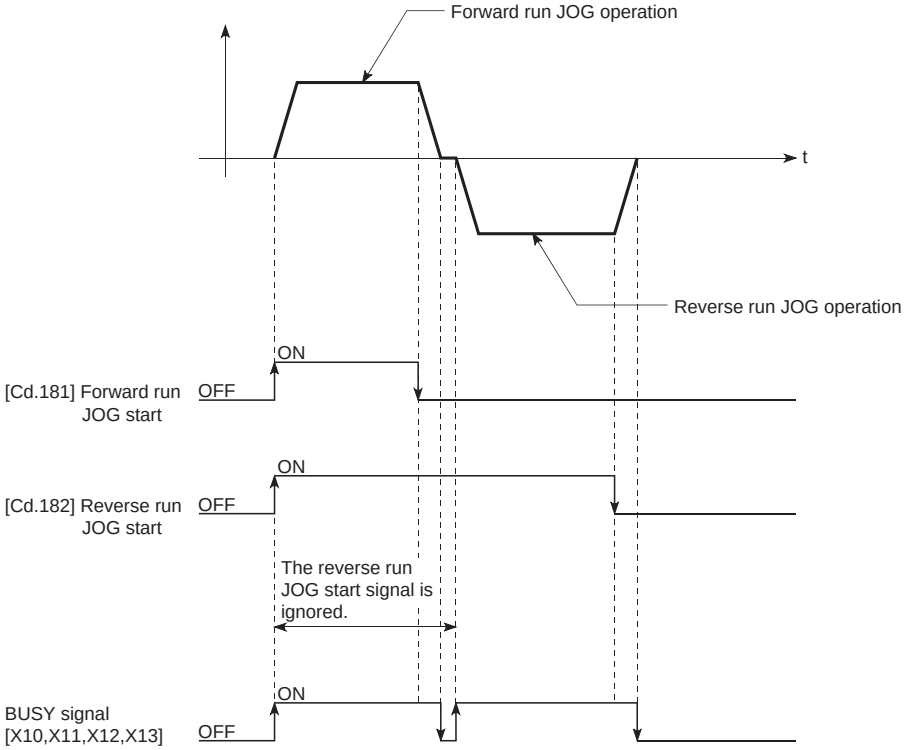
### ■RD77MS4 operation example


Ignores that the JOG start signal is turned ON from OFF while the stop signal is ON.
PLC READY signal [Y0]
All axis servo ON [Y1]
READY signal [X0]
[Cd.181] Forward run JOG start
[Cd.180] Axis stop
BUSY signal [X10,X11,X12,X13]
ON
OFF

## Example 2

When both the "forward run JOG start signal" and "reverse run JOG start signal" are turned ON simultaneously for one axis, the "forward run JOG start signal" is given priority. In this case, the "reverse run JOG start signal" is validated when the BUSY signal of Simple Motion module is turned OFF. If the forward run JOG operation is stopped due to stop by a stop signal or axis error, the reverse run JOG operation will not be executed even if the "reverse run JOG start signal" turns ON.

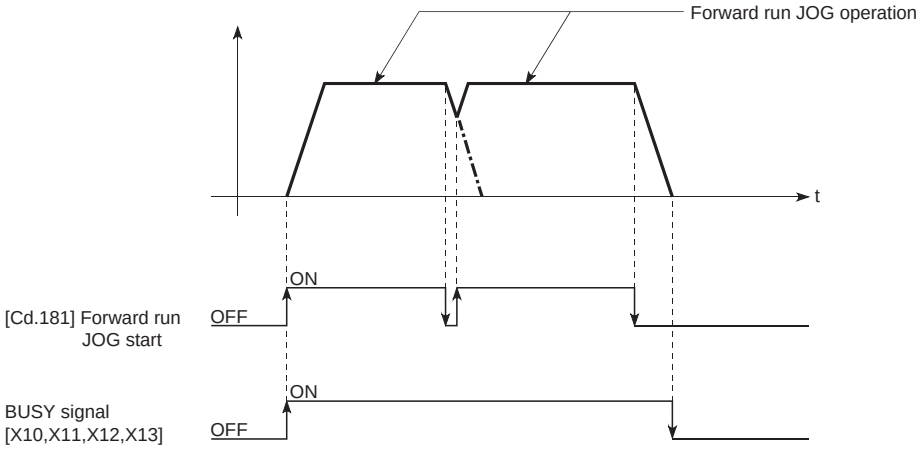
### ■RD77MS4 operation example




## Example 3

When the "JOG start signal" is turned ON again during deceleration caused by the ON → OFF of the "JOG start signal", the JOG operation will be carried out from the time the "JOG start signal" is turned ON.

### ■RD77MS4 operation example



# 5.3 Inching Operation

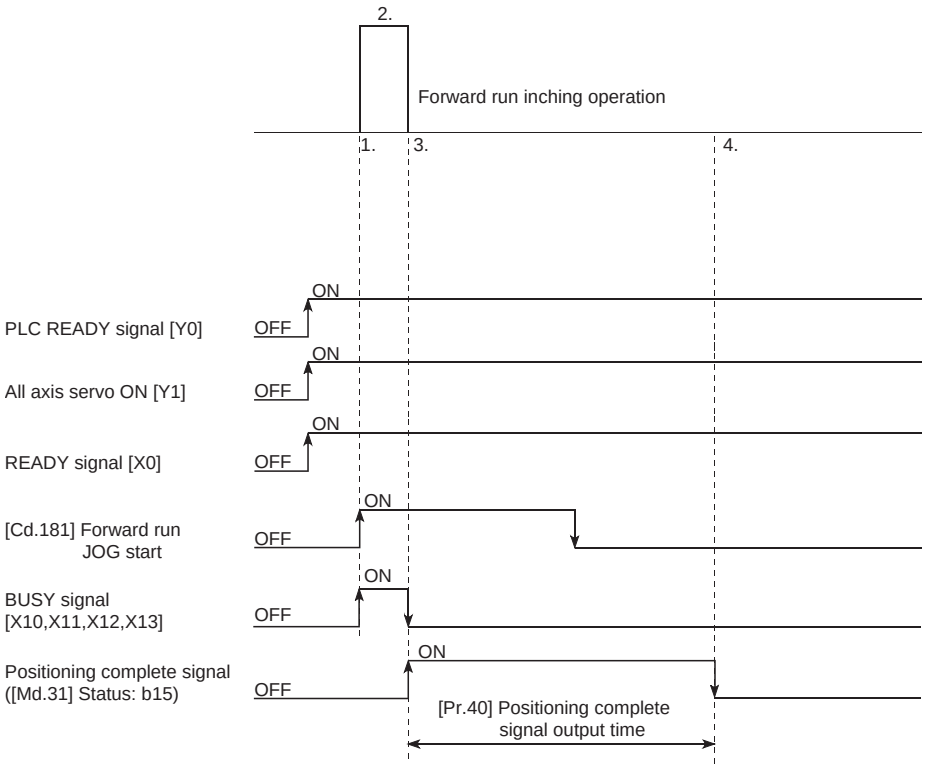
## Outline of inching operation

### Operation

In inching operation, pulses are output to the servo amplifier at operation cycle to move the workpiece by a designated movement amount after the forward run JOG start signal [Cd.181] or reverse JOG start signal [Cd.182] is turned ON.
The following shows the example of inching operation.

1. When the start signal is turned ON, inching operation is carried out in the direction designated by the start signal. In this case, BUSY signal is turned from OFF to ON.
2. The workpiece is moved by a movement amount set in "[Cd.16] Inching movement amount".
3. The workpiece movement stops when the speed becomes "0". In this case, BUSY signal is turned from ON to OFF. The positioning complete signal is turned from OFF to ON.
4. The positioning complete signal is turned from ON to OFF after a time set in "[Pr.40] Positioning complete signal output time" has been elapsed.

#### ■RD77MS4 operation example




**Restriction**

When the inching operation is carried out near the upper or lower limit, use the hardware stroke limit function. (☞ Page 243 Hardware stroke limit function)
If the hardware stroke limit function is not used, the workpiece may exceed the movement range, and an accident may result.

## Precautions during operation

The following details must be understood before inching operation is carried out.

• Acceleration/deceleration processing is not carried out during inching operation.

(Commands corresponding to the designated inching movement amount are output at operation cycle. When the movement direction of inching operation is reversed and backlash compensation is carried out, the backlash compensation amount and inching movement amount are output at the same operation cycle.)

The "[Cd.17] JOG speed" is ignored even if it is set. The error "Inching movement amount error" (error code: 1981H) will occur in the following case.

([Cd.16] Inching movement amount) × (A) > ([Pr.31] JOG speed limit value)

However, (A) is as follows.

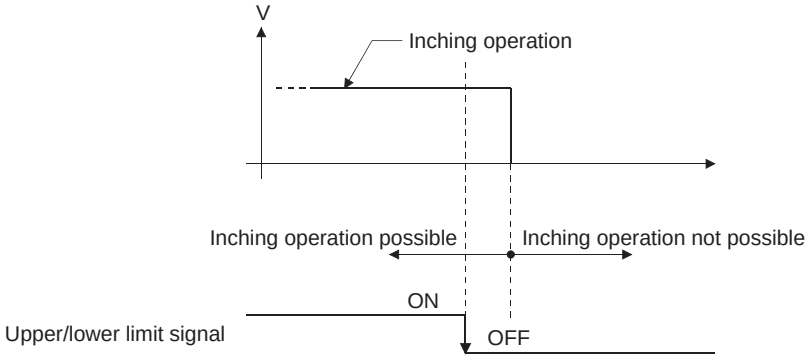
| Unit setting | Operation cycle | | | |
|---|---|---|---|---|
| | 0.444 ms | 0.888 ms | 1.777 ms | 3.555 ms |
| When the unit setting is pulse | 2250 | 1125 | 562.5 | 281.25 |
| When the unit setting is degree and the "[Pr.83] Speed control 10 × multiplier setting for degree axis" is valid | 135 | 67.5 | 33.75 | 16.875 |
| When the unit setting is other than the above | 1350 | 675 | 337.5 | 168.75 |

• Set a value other than a "0" in "[Cd.16] Inching movement amount".

If a "0" is set, the operation will become JOG operation. (☞ Page 165 JOG Operation)

## Operations when stroke limit error occurs

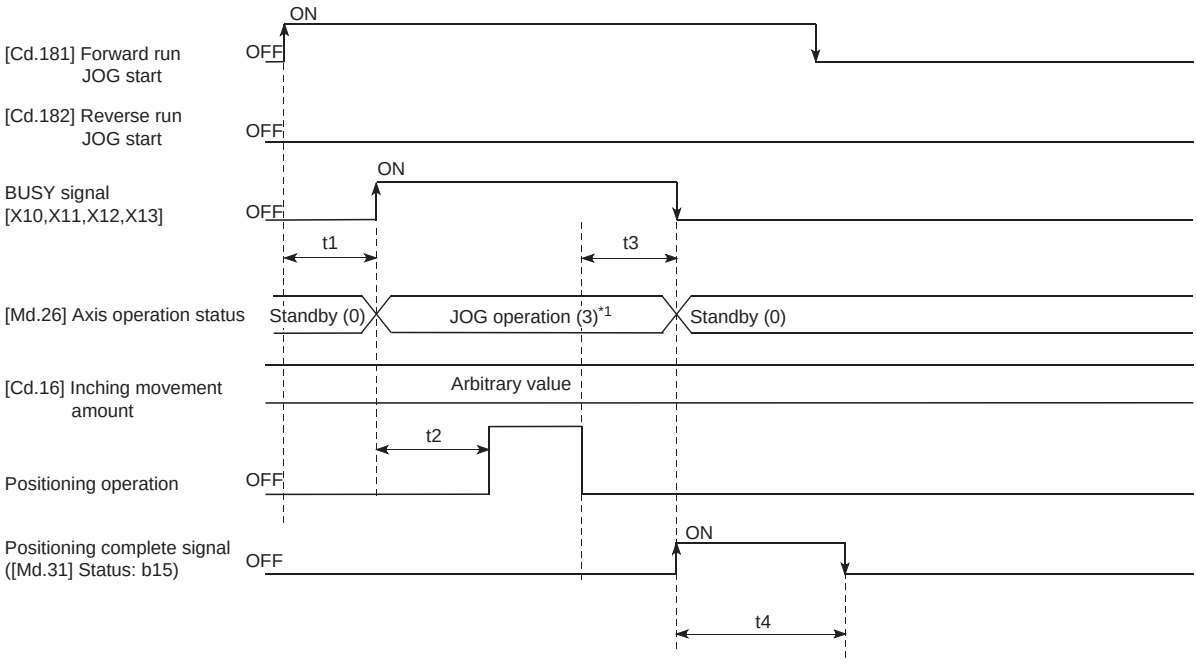
When the operation is stopped by hardware stroke limit error or software stroke limit error, the inching operation can be performed in an opposite way (direction within normal limits) after an error reset. (An error will occur again if JOG start signal is turned ON in a direction to outside the stroke limit.)



## Operation timing and processing times

The following drawing shows the details of the inching operation timing and processing time.

### ■RD77MS4 operation example




*1 "JOG operation" is set in "[Md.26] Axis operation status" even during inching operation.

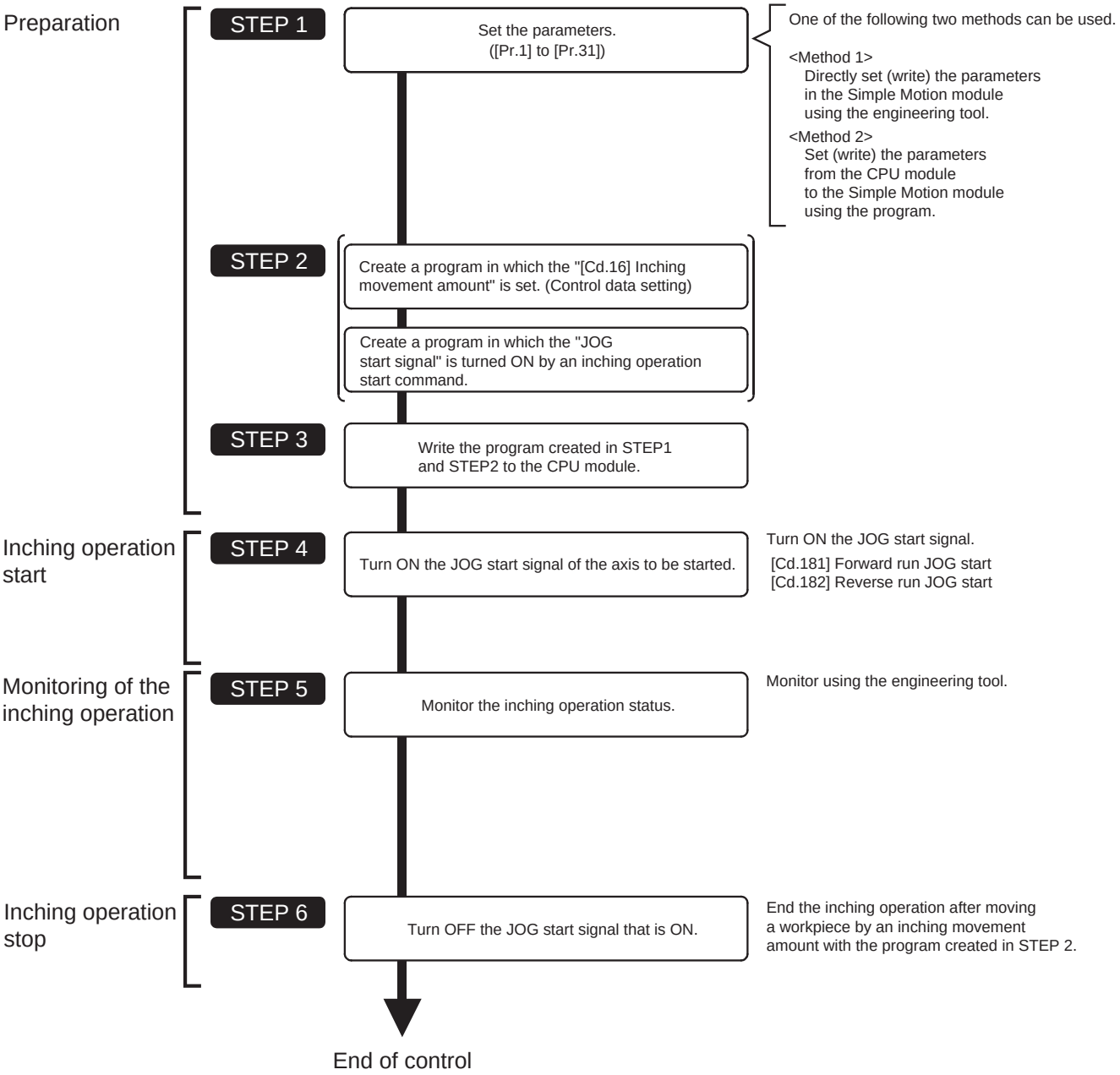
Normal timing time (Unit: [ms])

| Operation cycle | t1*1 | t2 | t3 | t4 |
|---|---|---|---|---|
| 0.444 | 0.211 to 0.545 | 1.218 to 1.684 | 0.000 to 0.444 | Follows parameters |
| 0.888 | 0.412 to 1.141 | 2.331 to 2.359 | 0.000 to 0.888 | Follows parameters |
| 1.777 | 0.767 to 1.976 | 4.524 to 5.706 | 0.000 to 1.777 | Follows parameters |
| 3.555 | 1.058 to 3.916 | 8.070 to 8.146 | 0.000 to 3.555 | Follows parameters |

*1 Depending on the operating statuses of the other axes, delay may occur in the t1 timing time.

# Inching operation execution procedure

The inching operation is carried out by the following procedure.


Preparation
STEP 1
Set the parameters.
([Pr.1] to [Pr.31])
One of the following two methods can be used.
<Method 1>
Directly set (write) the parameters
in the Simple Motion module
using the engineering tool.
<Method 2>
Set (write) the parameters
from the CPU module
to the Simple Motion module
using the program.
STEP 2
Create a program in which the "[Cd.16] Inching movement amount" is set. (Control data setting)
Create a program in which the "JOG start signal" is turned ON by an inching operation start command.
STEP 3
Write the program created in STEP1 and STEP2 to the CPU module.
Inching operation start
STEP 4
Turn ON the JOG start signal of the axis to be started.
Turn ON the JOG start signal.
[Cd.181] Forward run JOG start
[Cd.182] Reverse run JOG start
Monitoring of the inching operation
STEP 5
Monitor the inching operation status.
Monitor using the engineering tool.
Inching operation stop
STEP 6
Turn OFF the JOG start signal that is ON.
End the inching operation after moving a workpiece by an inching movement amount with the program created in STEP 2.
End of control

**Point**

- Mechanical elements such as limit switches are considered as already installed.
- Parameter settings work in common for all control using the Simple Motion module.

# Setting the required parameters for inching operation

The "Positioning parameters" must be set to carry out inching operation.

The following table shows the setting items of the required parameters for carrying out inching operation. Parameters not shown below are not required to be set for carrying out only inching operation. (Set the initial value or a value within the setting range.)

◎: Setting always required.

○: Set according to requirements (Set the initial value or a value within the setting range when not used.)

| Setting item | | | Setting requirement |
|---|---|---|---|
| Positioning parameters | [Pr.1] | Unit setting | ◎ |
| | [Pr.2] | Number of pulses per rotation (AP) (Unit: pulse) | ◎ |
| | [Pr.3] | Movement amount per rotation (AL) (Unit: pulse) | ◎ |
| | [Pr.4] | Unit magnification (AM) | ◎ |
| | [Pr.11] | Backlash compensation amount (Unit: pulse) | ○ |
| | [Pr.12] | Software stroke limit upper limit value (Unit: pulse) | ○ |
| | [Pr.13] | Software stroke limit lower limit value (Unit: pulse) | ○ |
| | [Pr.14] | Software stroke limit selection | ○ |
| | [Pr.15] | Software stroke limit valid/invalid setting | ○ |
| | [Pr.17] | Torque limit setting value (Unit: 0.1%) | ○ |
| | [Pr.31] | JOG speed limit value (Unit: pulse/s) | ◎ |

Refer to the following for the setting details.

☞ Page 407 Basic Setting

**Point**

- Positioning parameter settings work in common for all controls using the Simple Motion module. When carrying out other controls ("major positioning control", "high-level positioning control", and "home position return control"), set the respective setting items as well.
- Parameters are set for each axis.

# Creating a program to enable/disable the inching operation

A program must be created to execute an inching operation. Consider the "required control data setting", "start conditions", and "start time chart" when creating the program.

The following shows an example when an inching operation is started for axis 1. (The example shows the inching operation when a "10.0 μm" is set in "[Cd.16] Inching movement amount".)

## Required control data setting

The control data shown below must be set to execute an inching operation. The setting is carried out with the program.

n: Axis No. - 1

| Setting item | | Setting value | Setting details | Buffer memory address |
|---|---|---|---|---|
| [Cd.16] | Inching movement amount | 100 | Set the setting value so that the JOG speed limit value is not increased larger than the maximum output pulse | 4317+100n |

Refer to the following for the setting details.

☞ Page 504 Control Data

## Start conditions

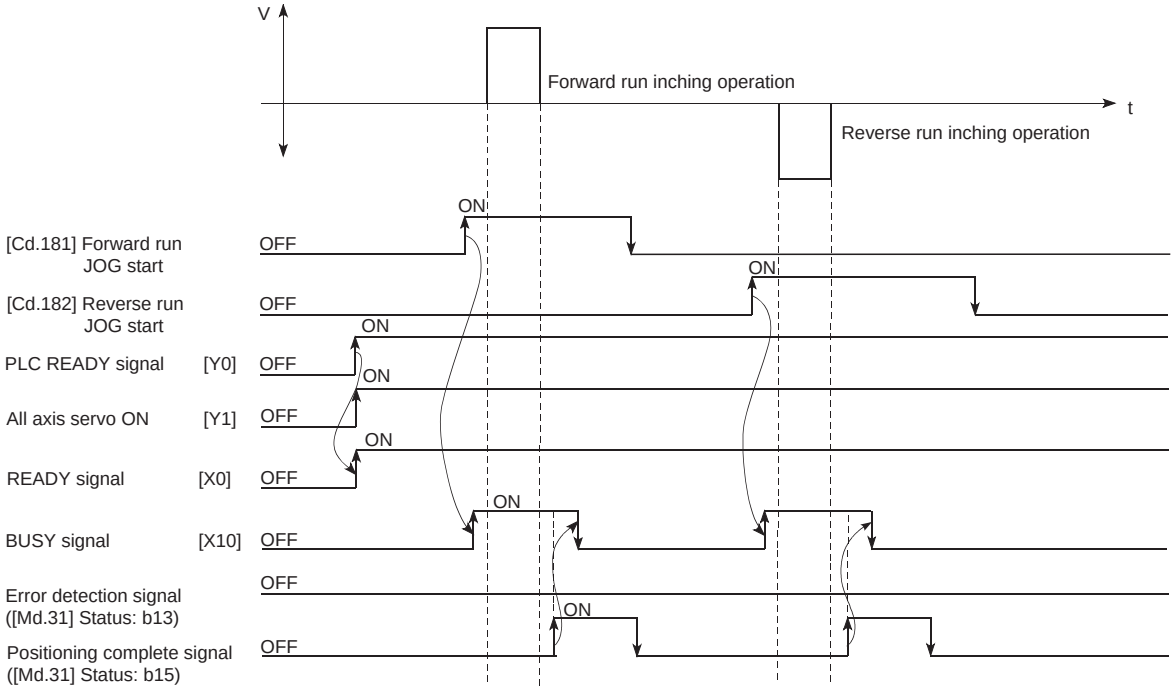
The following conditions must be fulfilled when starting. The required conditions must also be assembled in the program, and the program must be configured so the operation will not start if the conditions are not fulfilled.

| Signal name | | Signal state | | Device |
|---|---|---|---|---|
| Interface signal | PLC READY signal | ON | CPU module preparation completed | Y0 |
| | READY signal | ON | RD77MS preparation completed | X0 |
| | All axis servo ON | ON | All axis servo ON | Y1 |
| | Synchronization flag*1 | ON | The RD77MS buffer memory can be accessed. | X1 |
| | Axis stop signal | OFF | Axis stop signal is OFF | [Cd.180] Axis stop |
| | Start complete signal | OFF | Start complete signal is OFF | [Md.31] Status: b14 |
| | BUSY signal | OFF | RD77MS is not operating | X10 to X1F |
| | Positioning complete signal | OFF | Positioning complete signal is OFF | [Md.31] Status: b15 |
| | Error detection signal | OFF | There is no error | [Md.31] Status: b13 |
| | M code ON signal | OFF | M code ON signal is OFF | [Md.31] Status: b12 |
| External signal | Forced stop input signal | ON | There is no forced stop input | — |
| | Stop signal | OFF | Stop signal is OFF | — |
| | Upper limit (FLS) | ON | Within limit range | — |
| | Lower limit (RLS) | ON | Within limit range | — |

*1 The interlock must be provided so that the buffer memory is accessed after Synchronization flag [X1] turns on. When no interlock is provided, an unexpected value may be read or written.

## Start time chart

### ■RD77MS4 operation example




## Program example

Refer to the followings for the program example of the inching operation.

☞ Page 568 Inching operation setting program

☞ Page 568 JOG operation/inching operation execution program

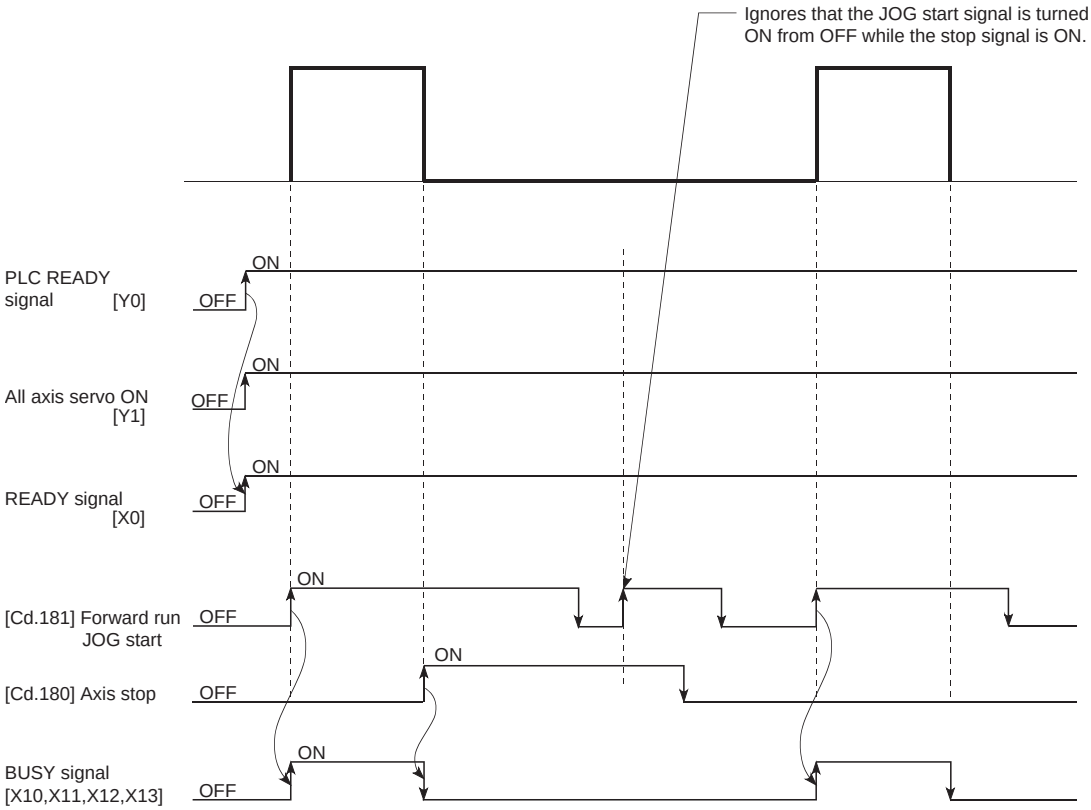
# Inching operation example

## Example 1

If the JOG start signal is turned ON while the stop signal is ON, the error "Stop signal ON at start" (error code: 1908H) will occur.

The inching operation can be re-started when the stop signal is turned OFF and the JOG start signal is turned ON from OFF.

### ■RD77MS4 operation example


Ignores that the JOG start signal is turned ON from OFF while the stop signal is ON.
PLC READY signal [Y0]
All axis servo ON [Y1]
READY signal [X0]
[Cd.181] Forward run JOG start
[Cd.180] Axis stop
BUSY signal [X10,X11,X12,X13]
ON
OFF

# 5.4 Manual Pulse Generator Operation

## Outline of manual pulse generator operation

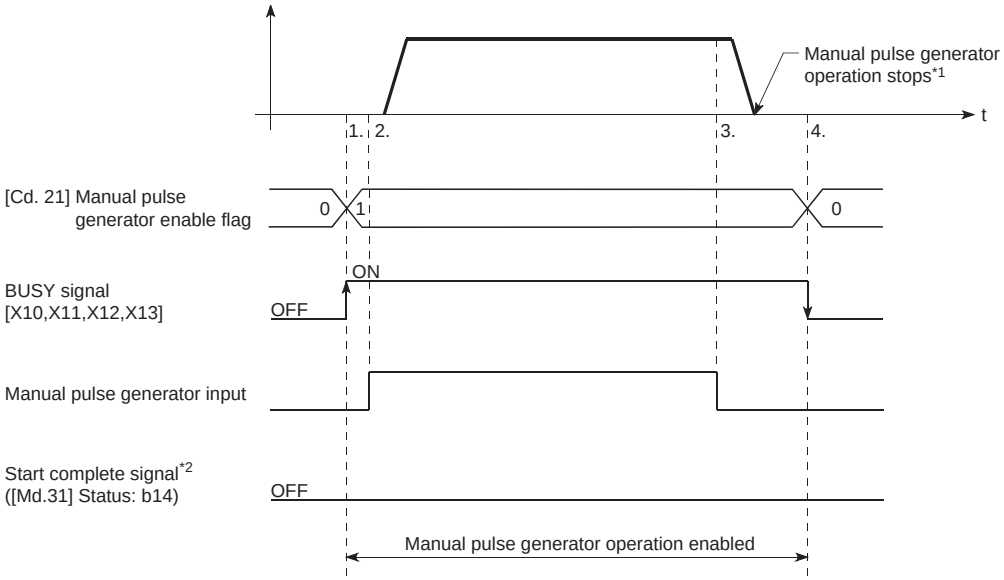
### Operation

In manual pulse generator operations, pulses are input to the Simple Motion module from the manual pulse generator. This causes the same number of input command to be output from the Simple Motion module to the servo amplifier, and the workpiece is moved in the designated direction.

The following shows an example of manual pulse generator operation.

1. When "[Cd.21] Manual pulse generator enable flag" is set to "1", the BUSY signal turns ON and the manual pulse generator operation is enabled.
2. The workpiece is moved corresponding to the number of pulses input from the manual pulse generator.
3. The workpiece movement stops when no more pulses are input from the manual pulse generator.
4. When "[Cd.21] Manual pulse generator enable flag" is set to "0", the BUSY signal turns OFF and the manual pulse generator operation is disabled.

#### ■RD77MS4 operation example




*1 If the input from the manual pulse generator stops or "0" is set in "[Cd.21] Manual pulse generator enable flag" during manual pulse generator operation, the machine will decelerate to a stop within 25 ms.

*2 The start complete signal does not turn ON in manual pulse generator operation.

**Restriction**

- Create the program so that "[Cd.21] Manual pulse generator enable flag" is always set to "0" (disabled) when a manual pulse generator operation is not carried out. Mistakenly touching the manual pulse generator when the "manual pulse generator enable flag" is set to "1" (enable) can cause accidents or incorrect positioning.
- A manual pulse generator is required to carry out manual pulse generator operation.

## Precautions during operation

The following details must be understood before carrying out manual pulse generator operation.

- If "[Pr.123] Manual pulse generator speed limit value" is set to a value larger than "[Pr.8] Speed limit value", the error "Manual pulse generator speed limit value error" (error code: 1ABBH) will occur and the operation will not start.
- If "[Cd.21] Manual pulse generator enable flag" is turned ON while the Simple Motion module is BUSY (BUSY signal ON), the warning "Start during operation" (warning code: 0900H) will occur.
- If a stop factor occurs during manual pulse generator operation, the operation will stop, and the BUSY signal will turn OFF. At this time, "[Cd.21] Manual pulse generator enable flag" will remain ON. However, manual pulse generator operation will not be possible. To carry out manual pulse generator operation again, measures must be carried out to eliminate the stop factor. Once eliminated, the operation can be carried out again by turning "[Cd.21] Manual pulse generator enable flag" ON → OFF → ON. (Note that this excludes hardware/software stroke limit error.)
- Command will not be output if an error occurs when the manual pulse generator operation starts.

**Restriction**

The speed command is issued according to the input from the manual pulse generator irrelevant of the speed limit setting. When the speed command is larger than 62914560 [pulse/s], the servo alarm "Command frequency error" (alarm No.: 35) will occur.
The following calculation formula is used to judge whether or not an error will occur.

$$\text{(Speed command)} = \text{Number of input pulses for one second} \times \text{Manual pulse generator 1 pulse input magnification} \times \text{Manual pulse generator 1 pulse movement amount} \times \frac{\text{Number of pulses per rotation}}{\text{Movement amount per rotation}}$$

If a large value is set to the manual pulse generator 1 pulse input magnification, there is a high possibility of the servo alarm "Command frequency error" (alarm No.: 35) occurrence. Note that the servomotor does not work rapidly by sudden pulse input even if the servo alarm does not occur.

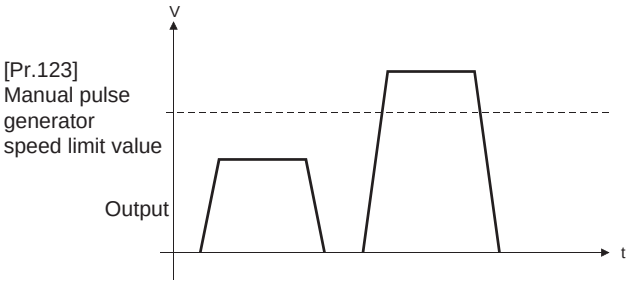
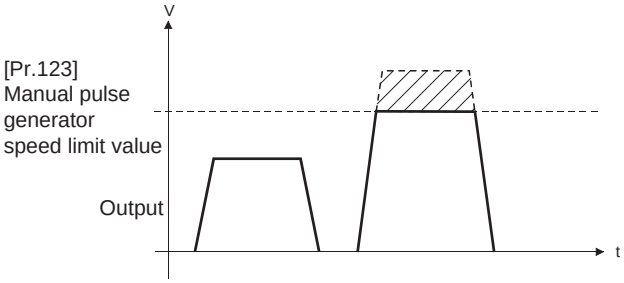
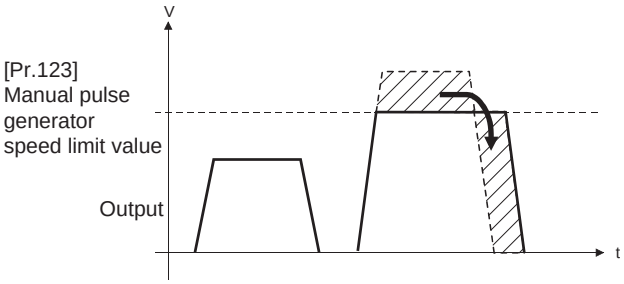
**Point**

- One Simple Motion module can be connected to one manual pulse generator.
- The Simple Motion module can simultaneously command to multiple servo amplifiers by one manual pulse generator. (Axis 1 to the number of maximum control axes)

## Manual pulse generator speed limit mode

In "[Pr.122] Manual pulse generator speed limit mode", the output operation which exceeds "[Pr.123] Manual pulse generator speed limit value" can be set during manual pulse generator operation.

The setting value and operation for "[Pr.122] Manual pulse generator speed limit mode" are shown below.

| Setting value | Operation |
|---|---|
| 0 | The speed limit by "[Pr.123] Manual pulse generator speed limit value" is not executed.<br>  |
| 1 | The pulses which exceed "[Pr.123] Manual pulse generator speed limit value" are not output.*1<br>  |
| 2 | The pulses which exceed "[Pr.123] Manual pulse generator speed limit value" are output later. The overcarrying movement amount which exceeds "[Pr.123] Manual pulse generator speed limit value" can be checked in "[Md.62] Amount of the manual pulser driving carrying over movement" (-2147483648 to 2147483647). When the movement amount which exceeds "[Pr.123] Manual pulse generator speed limit value" is generated continuously and "[Md.62] Amount of the manual pulser driving carrying over movement" exceeds tolerance (-2147483648 to 2147483647), the error "Overcarrying movement amount overflow in manual pulse generator" (error code: 1982H) occurs and a deceleration stop is executed.*2<br>  |

*1 When exceeding "[Pr.123] Manual pulse generator speed limit value", the input from the manual pulse generator is not the same as the output from the Simple Motion module.

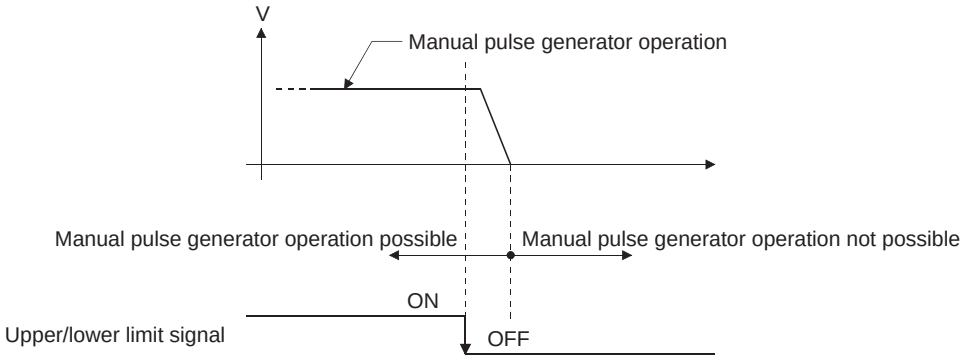
*2 When the pulses which exceed "[Pr.123] Manual pulse generator speed limit value" are large, it takes time between when the input from the manual pulse generator stops and when the output from the Simple Motion module stops.

When "1: Don't output over value of speed limit" or "2: Output over value of speed limit later" is set in "[Pr.122] Manual pulse generator speed limit mode", the warning "Outside manual pulse generator speed limit value" (warning code: 0989H) occurs at exceeding "[Pr.123] Manual pulse generator speed limit value".

## Operations when stroke limit error occurs

When the hardware stroke limit error or the software stroke limit error is detected*1 during operation, the operation will decelerate to a stop. However, in case of "[Md.26] Axis operation status", "Manual pulse generator operation" will continue*1. After stopping, manual pulse generator input pulses to the outside direction of the limit range are not accepted, but operation can be executed within the range.

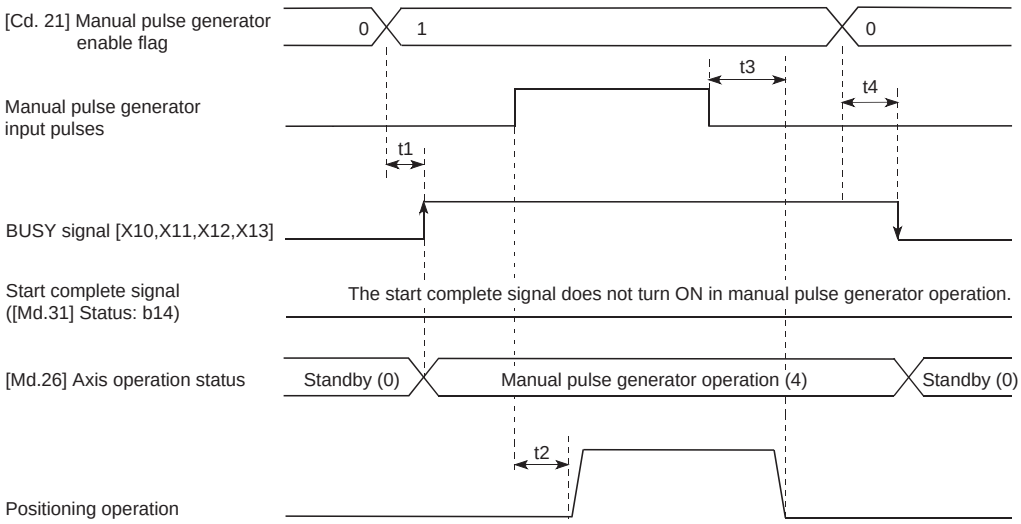
*1 Only when the current feed value or the machine feed value overflows or underflows during deceleration, the manual pulse generator operation will terminate as "error occurring". To carry out manual pulse generator operation again, "[Cd.21] Manual pulse generator enable flag" must be turned OFF once and turn ON.




## Operation timing and processing time

The following drawing shows details of the manual pulse generator operation timing and processing time.

### ■RD77MS4 operation example




Normal timing time (Unit: [ms])

| Operation cycle | t1*1 | t2 | t3 | t4 |
|---|---|---|---|---|
| 0.444 | 0.430 to 0.438 | 10.065 to 21.810 | 14.530 to 23.095 | 7.266 to 15.646 |
| 0.888 | 0.865 to 0.874 | 10.065 to 21.810 | 14.530 to 23.095 | 7.266 to 15.646 |
| 1.777 | 1.735 to 1.748 | 10.065 to 21.810 | 14.530 to 23.095 | 7.266 to 15.646 |
| 3.555 | 3.512 to 3.534 | 10.065 to 21.810 | 14.530 to 23.095 | 7.266 to 15.646 |

*1 Delays may occur in the t1 timing time due to the operation status of other axes.

## Position control by manual pulse generator operation

In manual pulse generator operation, the position is moved by a "manual pulse generator 1 pulse movement amount" per pulse. The current feed value in the positioning control by manual pulse generator operation can be calculated using the expression shown below.

Current feed value = Number of input pulses × [Cd.20] Manual pulse generator 1 pulse input magnification × Manual pulse generator 1 pulse movement amount

| [Pr.1] Unit setting | mm | inch | degree | pulse |
|---|---|---|---|---|
| Manual pulse generator 1 pulse movement amount | 0.1 μm | 0.00001 inch | 0.00001 degree | 1 pulse |

For example, when "[Pr.1] Unit setting" is mm and "[Cd.20] Manual pulse generator 1 pulse input magnification" is 2, and 100 pulses are input from the manual pulse generator, the current feed value is as follows.

100 × 2 × 0.1 = 20 [μm] ("[Md.20] Current feed value" = 200)

The number of pulses output actually to the servo amplifier is "Manual pulse generator 1pulse movement amount/movement amount per pulse".

The movement amount per pulse can be calculated using the expression shown below.

$$\text{Movement amount per pulse} = \frac{\text{[Pr.3] Movement amount per rotation(AL)}}{\text{[Pr.2] Number of pulses per rotation(AP)}} \times \text{[Pr.4] Unit magnification(AM)}$$

For example, when "[Pr.1] Unit setting" is mm and the movement amount per pulse is 1 μm, 0.1/1 = 1/10, i.e., the output to the servo amplifier per pulse from the manual pulse generator is 1/10 pulse. Thus, the Simple Motion module outputs 1 pulse to the servo amplifier after receiving 10 pulses from the manual pulse generator.

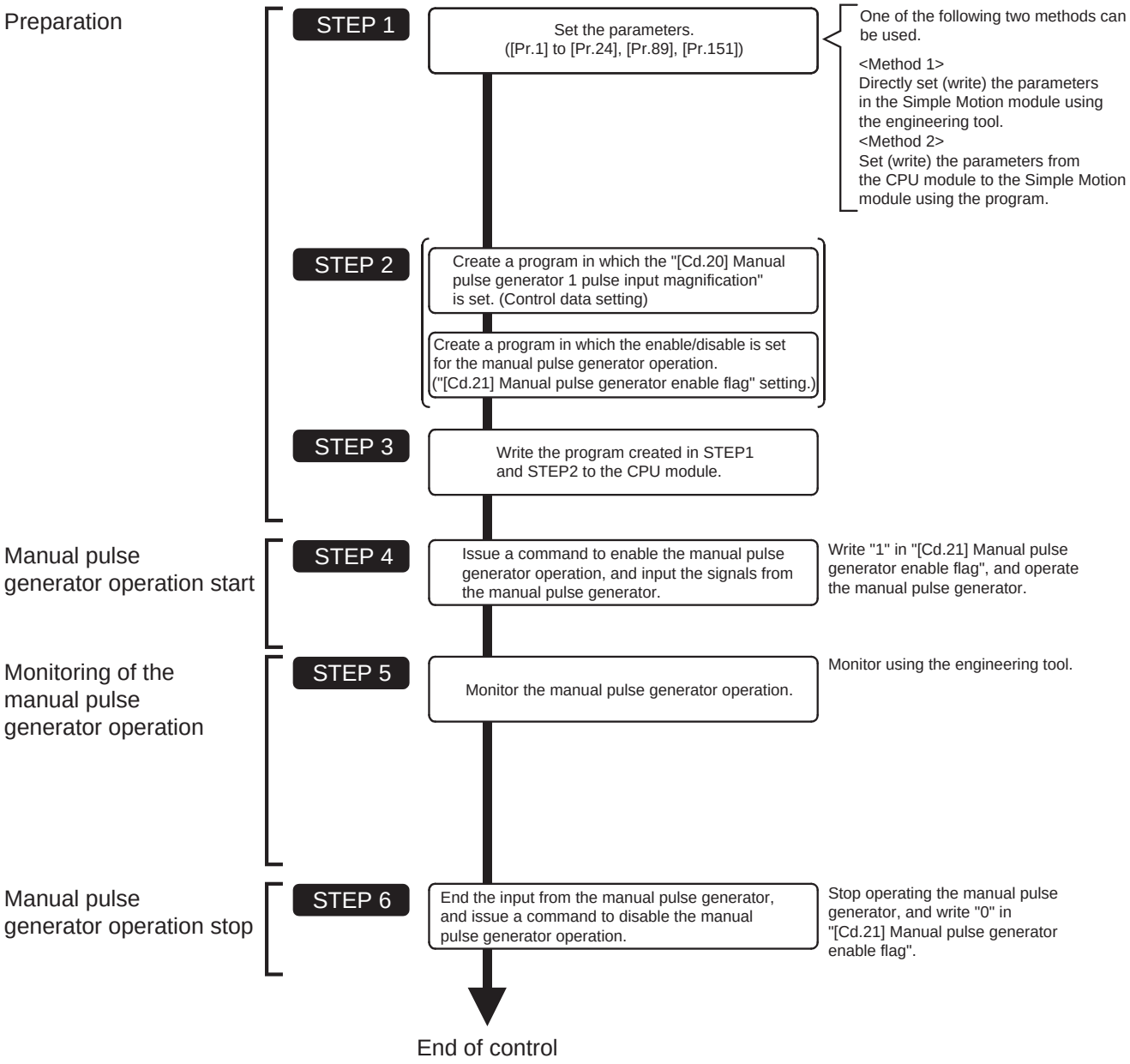
## Speed control by manual pulse generation operation

The speed during positioning control by manual pulse generator operation is a speed corresponding to the number of input pulses per unit time, and can be obtained using the following equation.

Output command frequency = Input frequency × [Cd.20] Manual pulse generator 1 pulse input magnification

# Manual pulse generator operation execution procedure

The manual pulse generator operation is carried out by the following procedure.


Preparation
STEP 1
Set the parameters.
([Pr.1] to [Pr.24], [Pr.89], [Pr.151])
One of the following two methods can be used.
<Method 1>
Directly set (write) the parameters in the Simple Motion module using the engineering tool.
<Method 2>
Set (write) the parameters from the CPU module to the Simple Motion module using the program.
STEP 2
Create a program in which the "[Cd.20] Manual pulse generator 1 pulse input magnification" is set. (Control data setting)
Create a program in which the enable/disable is set for the manual pulse generator operation. ("[Cd.21] Manual pulse generator enable flag" setting.)
STEP 3
Write the program created in STEP1 and STEP2 to the CPU module.
Manual pulse generator operation start
STEP 4
Issue a command to enable the manual pulse generator operation, and input the signals from the manual pulse generator.
Write "1" in "[Cd.21] Manual pulse generator enable flag", and operate the manual pulse generator.
Monitoring of the manual pulse generator operation
STEP 5
Monitor the manual pulse generator operation.
Monitor using the engineering tool.
Manual pulse generator operation stop
STEP 6
End the input from the manual pulse generator, and issue a command to disable the manual pulse generator operation.
Stop operating the manual pulse generator, and write "0" in "[Cd.21] Manual pulse generator enable flag".
End of control

**Point**

- Mechanical elements such as limit switches are considered as already installed.
- Parameter settings work in common for all control using the Simple Motion module.

# Setting the required parameters for manual pulse generator operation

The "Positioning parameters" and "Common parameters" must be set to carry out manual pulse generator operation.
The following table shows the setting items of the required parameters for carrying out manual pulse generator operation.
Parameters not shown below are not required to be set for carrying out only manual pulse generator operation. (Set the initial value or a value within the setting range.)

◎: Setting always required.

○: Set according to requirements (Set the initial value or a value within the setting range when not used.)

| Setting item | | | Setting requirement |
|---|---|---|---|
| Positioning parameters | [Pr.1] | Unit setting | ◎ |
| | [Pr.2] | Number of pulses per rotation (AP) (Unit: pulse) | ◎ |
| | [Pr.3] | Movement amount per rotation (AL) (Unit: pulse) | ◎ |
| | [Pr.4] | Unit magnification (AM) | ◎ |
| | [Pr.8] | Speed limit value (Unit: pulse/s) | ◎ |
| | [Pr.11] | Backlash compensation amount (Unit: pulse) | ○ |
| | [Pr.12] | Software stroke limit upper limit value (Unit: pulse) | ○ |
| | [Pr.13] | Software stroke limit lower limit value (Unit: pulse) | ○ |
| | [Pr.14] | Software stroke limit selection | ○ |
| | [Pr.15] | Software stroke limit valid/invalid setting | ○ |
| | [Pr.17] | Torque limit setting value (Unit: 0.1%) | ○ |
| Common parameters | [Pr.24] | Manual pulse generator/Incremental synchronous encoder input selection | ○ |
| | [Pr.89] | Manual pulse generator/Incremental synchronous encoder input type selection | ◎ |
| | [Pr.151] | Manual pulse generator/Incremental synchronous encoder input logic selection | ○ |

Refer to the following for the setting details.

☞ Page 407 Basic Setting

**Point**

- Positioning parameter settings and common parameters settings work in common for all controls using the Simple Motion module. When carrying out other controls ("major positioning control", "high-level positioning control", "home position return control"), set the respective setting items as well.
- "Positioning parameters" are set for each axis.

# Creating a program to enable/disable the manual pulse generator operation

A program must be created to execute a manual pulse generator operation. Consider the "required control data setting", "start conditions" and "start time chart" when creating the program.

The following shows an example when a manual pulse generator operation is started for axis 1.

## Required control data setting

The control data shown below must be set to execute a manual pulse generator operation. The setting is carried out with the program.

n: Axis No. - 1

| Setting item | | Setting value | Setting details | Buffer memory address |
|---|---|---|---|---|
| [Cd.20] | Manual pulse generator 1 pulse input magnification | 1 | Set the manual pulse generator 1 pulse input magnification. (1 to 10000 times) | 4322+100n<br>4323+100n |
| [Cd.21] | Manual pulse generator enable flag | 1 (0) | Set "1: Enable manual pulse generator operation".<br>(Set "0: Disable manual pulse generator operation" when finished with the manual pulse generator operation.) | 4324+100n |

Refer to the following for the setting details.

☞ Page 504 Control Data

## Start conditions

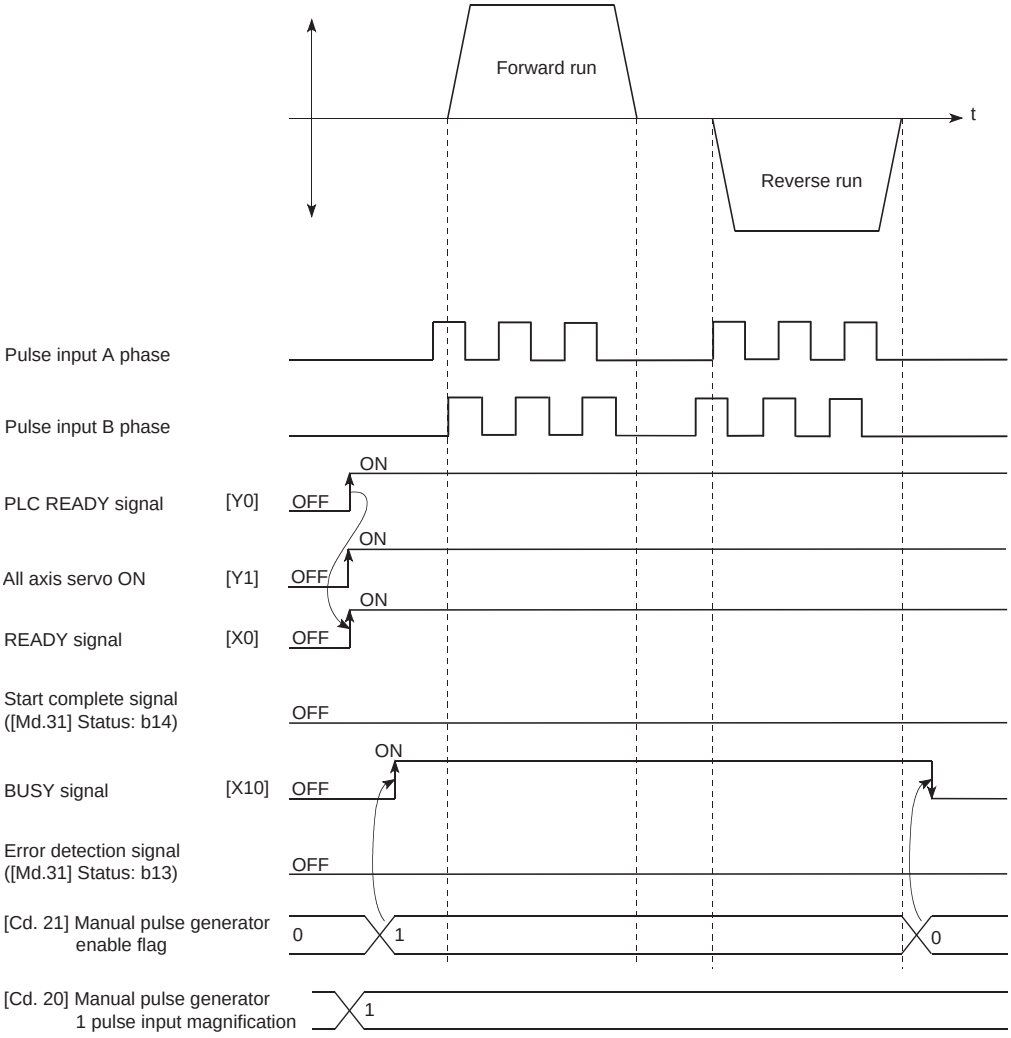
The following conditions must be fulfilled when starting. The required conditions must also be assembled in the program, and the program must be configured so the operation will not start if the conditions are not fulfilled.

| Signal name | | Signal state | | Device |
|---|---|---|---|---|
| Interface signal | PLC READY signal | ON | CPU module preparation completed | Y0 |
| | READY signal | ON | RD77MS preparation completed | X0 |
| | All axis servo ON | ON | All axis servo ON | Y1 |
| | Synchronization flag*1 | ON | The RD77MS buffer memory can be accessed. | X1 |
| | Axis stop signal | OFF | Axis stop signal is OFF | [Cd.180] Axis stop |
| | Start complete signal | OFF | Start complete signal is OFF | [Md.31] Status: b14 |
| | BUSY signal | OFF | RD77MS is not operating | X10 to X1F |
| | Error detection signal | OFF | There is no error | [Md.31] Status: b13 |
| | M code ON signal | OFF | M code ON signal is OFF | [Md.31] Status: b12 |
| External signal | Forced stop input signal | ON | There is no forced stop input | — |
| | Stop signal | OFF | Stop signal is OFF | — |
| | Upper limit (FLS) | ON | Within limit range | — |
| | Lower limit (RLS) | ON | Within limit range | — |

*1 The interlock must be provided so that the buffer memory is accessed after Synchronization flag [X1] turns on. When no interlock is provided, an unexpected value may be read or written.

## Start time chart

### ■RD77MS4 operation example




## Program example

Refer to the following for the program example of the manual pulse generator operation.

☞ Page 568 Manual pulse generator operation program

# 6 INTER-MODULE SYNCHRONIZATION FUNCTION

This function can synchronize the control timings among multiple modules on the same base.

## Control details

This function can synchronize the interrupt program execution cycle of the CPU module and the operation cycle of the Simple Motion module. Refresh which is synchronized with the operation cycle can be executed between the devices and labels of the buffer memory address and CPU module.

## Precautions during control

The following shows the available synchronization cycle to synchronize within the Simple Motion modules.
0.222 ms, 0.444 ms, 0.888 ms, 1.777 ms, 3.555 ms, 7.111 ms
When the synchronization cycle except above, the error "Unit synchronization cycle setting unsupported" (error code: 18C0H) will occur.
There is no need to match the synchronization cycle to the operation cycle of the Simple Motion module. Note that the value of buffer memory address is updated and referred to at the operation cycle. Therefore, when the synchronization cycle is faster than the operation cycle, the monitor data is updated at each operation cycle, and the positioning start signal and control data, etc. are not processed if only the synchronization cycle is ON for only 1 scan. When the synchronization cycle is slower than the operation cycle, data may be skipped in the synchronization cycle interrupt program if the monitor data changes only during 1 operation cycle.
When executing the simultaneous start using inter-module synchronization, the synchronization cycle and the operation cycle of the Simple Motion module must be matched. Refer to the following for details.
☞ Page 191 Simultaneous start using inter-module synchronization

## Setting method for inter-module synchronization

The inter-module synchronization can be set at "Synchronization Setting within the Modules" in "System parameter" of the engineering tool. Select "Use" for "Use Inter-module Synchronization Function in System" at "Synchronization Setting within the Modules" and set "Synchronize" in the setting field for the Simple Motion module to be synchronized at "Detailed Setting" of "Select Synchronous Target Unit between Unit". Set the inter-module synchronization cycle at "Synchronous Fixed Scan Interval Setting within the Modules". Select the cycle to be synchronized at "Fixed Scan Interval Setting (Not Set by 0.05 ms)".

## Simultaneous start using inter-module synchronization

This function is used to synchronize the start timing between different modules. It can synchronize the start timing between modules by using with the pre-reading start function together. After starting, the Simple Motion module operates independently.
Refer to the following for "Pre-reading start function".
☞ Page 266 Pre-reading start function

### ■Procedure

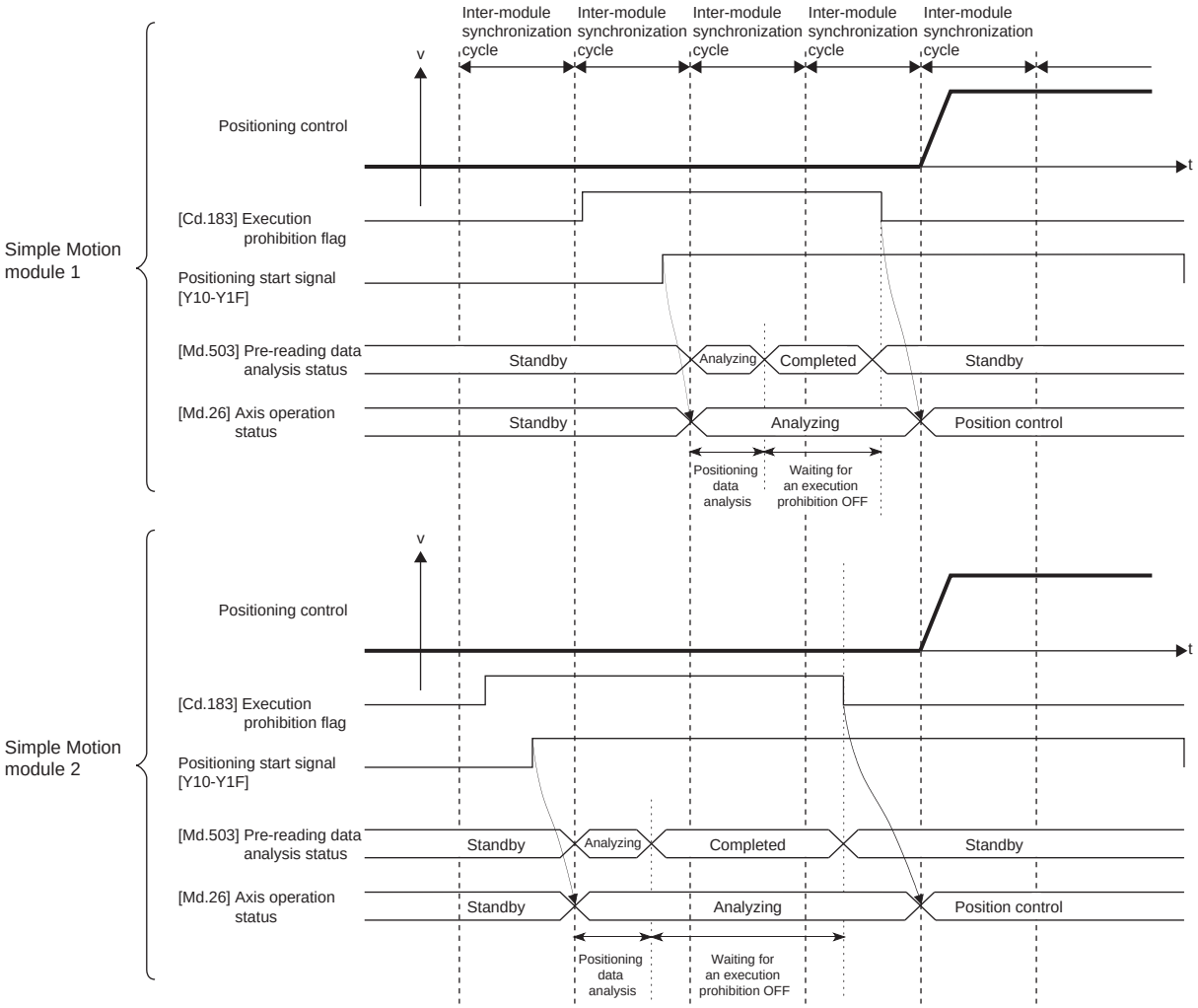
1. Set the Simple Motion module to start simultaneously to the inter-module synchronous target.
2. Set the same cycle between the inter-module synchronization cycle of the CPU module and the operation cycle of the Simple Motion module. If not, the simultaneous start is not guaranteed.
3. Use the pre-reading start function. Execute the positioning start after turning "[Cd.183] Execution prohibition flag" ON.
4. Turn "[Cd.183] Execution prohibition flag" OFF in the same inter-module synchronization cycle during the inter-module synchronous interrupt program (I44).

Ex.
To execute the inter-module synchronous interrupt program (I44) as an event, set "Type: Event" and "Detailed Setting Information: Interrupt I44" to the execution type of the program to execute in "Program Setting" of "CPU Parameter".

## Precautions

- Turn "[Cd.183] Execution prohibition flag" OFF after "[Md.503] Pre-reading data analysis status" is set to "2: Completed".
- Because each positioning module operates independently after starting, it operates as follows. (Even though an error occurs and the module stops, the module where an error has not occurred continues to operate. Even though the stop signal is input in the program at the same time, the detection timing of the stop signal may not be the same and the stop position may differ.)
- When the inter-module synchronization is enabled, "[Cd.183] Execution prohibition flag" is read during the processing caused by the interrupt of the inter-module synchronous interrupt (I44). Therefore, even if "[Cd.183] Execution prohibition flag" is operated without the inter-module synchronous interrupt (I44), "[Cd.183] Execution prohibition flag" is not read. If the inter-module synchronous interrupt (I44) is used, the processing is executed without any operation of "[Cd.183] Execution prohibition flag" in the event. However, the inter-module synchronization start is not guaranteed.
- When the inter-module synchronous interrupt (I44) exceeds the internal operation process time of the Simple Motion module, the warning "Inter-module synchronization cycle time over" (warning code: 0CC0H) occurs. Even at the time, the module where an error has not occurred continues to operate.

### ■RD77MS16 operation example



# 7 EXPANSION CONTROL

The details and usage of expansion control are explained in this chapter.
Expansion control includes the speed-torque control to execute the speed control and torque control not including position loop and the synchronous control to synchronize with input axis using software with "synchronous control parameter" instead of controlling mechanically with gear, shaft, speed change gear or cam, etc.
Execute the required settings to match each control.

## 7.1 Speed-torque Control

### Outline of speed-torque control

This function is used to execute the speed control or torque control that does not include the position loop for the command to servo amplifier.
"Continuous operation to torque control mode" that switches the control mode to torque control mode without stopping the servomotor during positioning operation is also available for tightening a bottle cap or a screw.
Switch the control mode from "position control mode" to "speed control mode", "torque control mode" or "continuous operation to torque control mode" to execute the "Speed-torque control".

| Control mode | Control | Remark |
|---|---|---|
| Position control mode | Positioning control, home position return control, JOG operation, Inching operation and Manual pulse generator operation | Control that include the position loop for the command to servo amplifier |
| Speed control mode | Speed-torque control | Control that does not include the position loop for the command to servo amplifier |
| Torque control mode | | |
| Continuous operation to torque control mode | | Control that does not include the position loop for the command to servo amplifier<br>Control mode can be switched during positioning control or speed control. |

Use the servo amplifiers whose software versions are compatible with each control mode to execute the "Speed-torque control".
Servo amplifier software versions that are compatible with each control mode are shown below.
—: There is no restriction by the version.

| Servo amplifier model | Software version | | |
|---|---|---|---|
| | Speed control | Torque control | Continuous operation to torque control*1 |
| MR-J4(W)-B/MR-JE-B | — | — | — |
| MR-J3-_B | — | B3 or later | C7 or later |
| MR-J3W-_B | — | — | Not compatible |
| MR-J3-_BS | — | — | C7 or later |

*1 The torque generation direction of servomotor can be changed by setting the servo parameter "Function selection C-B POL reflection selection at torque control (PC29)" for the servo amplifier that is compatible with the continuous operation to torque control. (☞ Page 197 Operation of speed-torque control)
For the servo amplifier that is not compatible with the continuous operation to torque control, the operation is the same as that of when "0: Enabled" is set in servo parameter "Function selection C-B POL reflection selection at torque control (PC29)".

## ⚠CAUTION

• If operation that generates torque more than 100% of the rating is performed with an abnormally high frequency in a servomotor stop status (servo lock status) or in a 30 r/min or less low-speed operation status, the servo amplifier may malfunction regardless of the electronic thermal relay protection.

# Setting the required parameters for speed-torque control

The "Positioning parameters" must be set to carry out speed-torque control.

The following table shows the setting items of the required parameters for carrying out speed-torque control. Parameters not shown below are not required to be set for carrying out only speed-torque control. (Set the initial value or a value within the setting range.)

◎: Setting always required.

○: Set according to requirements (Set the initial value or a value within the setting range when not used.)

| Setting item | | | Setting requirement |
|---|---|---|---|
| Positioning parameters | [Pr.1] | Unit setting | ◎ |
| | [Pr.2] | Number of pulses per rotation (AP) | ◎ |
| | [Pr.3] | Movement amount per rotation (AL) | ◎ |
| | [Pr.4] | Unit magnification (AM) | ◎ |
| | [Pr.8] | Speed limit value | ◎ |
| | [Pr.12] | Software stroke limit upper limit value | ○ |
| | [Pr.13] | Software stroke limit lower limit value | ○ |
| | [Pr.14] | Software stroke limit selection | ○ |
| | [Pr.22] | Input signal logic selection | ◎ |
| | [Pr.83] | Speed control 10 × multiplier setting for degree axis | ○ |
| | [Pr.90] | Operation setting for speed-torque control mode | ○ |
| Common parameters | [Pr.82] | Forced stop valid/invalid selection | ○ |

Refer to the following for the setting details.

☞ Page 407 Basic Setting

**Point**

- Positioning parameter settings and common parameters settings work in common for all controls using the Simple Motion module. When carrying out other controls ("major positioning control", "high-level positioning control", "home position return control"), set the respective setting items as well.
- "Positioning parameters" are set for each axis.

# Setting the required data for speed-torque control

## Required control data setting for the control mode switching

The control data shown below must be set to execute the control mode switching.

n: Axis No. - 1

| Setting item | | Setting value | Setting details | Buffer memory address |
|---|---|---|---|---|
| [Cd.138] | Control mode switching request | 1 | Set "1: Switching request" after setting "[Cd.139] Control mode setting". | 4374+100n |
| [Cd.139] | Control mode setting | → | Set the control mode to switch.<br>0: Position control mode<br>10: Speed control mode<br>20: Torque control mode<br>30: Continuous operation to torque control mode | 4375+100n |

Refer to the following for the setting details.

☞ Page 504 Control Data

When "30: Continuous operation to torque control mode" is set, set the switching condition of the control mode to switch to the continuous operation to torque control mode.

The control data shown below must be set to set the switching condition of control mode.

n: Axis No. - 1

| Setting item | | Setting value | Setting details | Buffer memory address |
|---|---|---|---|---|
| [Cd.153] | Control mode auto-shift selection | → | Set the switching condition when switching to continuous operation to torque control mode.<br>0: No switching condition<br>1: Current feed value pass<br>2: Real current value pass | 4393+100n |
| [Cd.154] | Control mode auto-shift parameter | → | Set the condition value when setting the control mode switching condition. | 4394+100n<br>4395+100n |

Refer to the following for the setting details.

☞ Page 504 Control Data

## Required control data setting for the speed control mode

The control data shown below must be set to execute the speed control.

n: Axis No. - 1

| Setting item | | Setting value | Setting details | Buffer memory address |
|---|---|---|---|---|
| [Cd.140] | Command speed at speed control mode | → | Set the command speed at speed control mode. | 4376+100n<br>4377+100n |
| [Cd.141] | Acceleration time at speed control mode | → | Set the acceleration time at speed control mode. | 4378+100n |
| [Cd.142] | Deceleration time at speed control mode | → | Set the deceleration time at speed control mode. | 4379+100n |

Refer to the following for the setting details.

☞ Page 504 Control Data

## Required control data setting for the torque control mode

The control data shown below must be set to execute the torque control.

n: Axis No. - 1

| Setting item | | Setting value | Setting details | Buffer memory address |
|---|---|---|---|---|
| [Cd.143] | Command torque at torque control mode | → | Set the command torque at torque control mode. | 4380+100n |
| [Cd.144] | Torque time constant at torque control mode (Forward direction) | → | Set the time constant at driving during torque control mode. | 4381+100n |
| [Cd.145] | Torque time constant at torque control mode (Negative direction) | → | Set the time constant at regeneration during torque control mode. | 4382+100n |
| [Cd.146] | Speed limit value at torque control mode | → | Set the speed limit value at torque control mode. | 4384+100n<br>4385+100n |

Refer to the following for the setting details.

☞ Page 504 Control Data

## Required control data setting for the continuous operation to torque control mode

The control data shown below must be set to execute the continuous operation to torque control.

n: Axis No. - 1

| Setting item | | Setting value | Setting details | Buffer memory address |
|---|---|---|---|---|
| [Cd.147] | Speed limit value at continuous operation to torque control mode | → | Set the speed limit value at continuous operation to torque control mode. | 4386+100n<br>4387+100n |
| [Cd.148] | Acceleration time at continuous operation to torque control mode | → | Set the acceleration time at continuous operation to torque control mode. | 4388+100n |
| [Cd.149] | Deceleration time at continuous operation to torque control mode | → | Set the deceleration time at continuous operation to torque control mode. | 4389+100n |
| [Cd.150] | Target torque at continuous operation to torque control mode | → | Set the target torque at continuous operation to torque control mode. | 4390+100n |
| [Cd.151] | Torque time constant at continuous operation to torque control mode (Forward direction) | → | Set the time constant at driving during continuous operation to torque control mode. | 4391+100n |
| [Cd.152] | Torque time constant at continuous operation to torque control mode (Negative direction) | → | Set the time constant at regeneration during continuous operation to torque control mode. | 4392+100n |

Refer to the following for the setting details.

☞ Page 504 Control Data

# Operation of speed-torque control

## Switching of control mode (Speed control/Torque control)

### ■Switching method of control mode

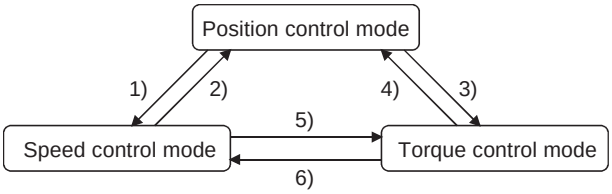
To switch the control mode to the speed control or the torque control, set "1" in "[Cd.138] Control mode switching request" after setting the control mode in "[Cd.139] Control mode setting".

When the mode is switched to the speed control mode or the torque control mode, the control data used in each control mode must be set before setting "1" in "[Cd.138] Control mode switching request".

When the switching condition is satisfied at control mode switching request, "30: Control mode switch" is set in "[Md.26] Axis operation status", and the BUSY signal turns ON. "0" is automatically stored in "[Cd.138] Control mode switching request" by Simple Motion module after completion of switching.

The warning "Control mode switching during BUSY" (warning code: 09E6H) or "Control mode switching during zero speed OFF" (warning code: 09E7H) occurs if the switching condition is not satisfied, and the control mode is not switched.

The following shows the switching condition of each control mode.




| Switching operation | | Switching condition |
|---|---|---|
| 1) | Position control mode → Speed control mode | Not during positioning*1 and during motor stop*2*3 |
| 2) | Speed control mode → Position control mode | During motor stop*2*3 |
| 3) | Position control mode → Torque control mode | Not during positioning*1 and during motor stop*2*3 |
| 4) | Torque control mode → Position control mode | During motor stop*2*3 |
| 5) | Speed control mode → Torque control mode | None |
| 6) | Torque control mode → Speed control mode | |

*1 BUSY signal is OFF.

*2 ZERO speed ([Md.119] Servo status2: b3) is ON.

n: Axis No. - 1

| Monitor item | Buffer memory address |
|---|---|
| [Md.119] Servo status2: b3 | 2476+100n |

*3 The control mode can be changed without checking the switching condition of "during motor stop" in Simple Motion module by setting "1: Zero speed ON condition invalid (for switching control mode)" in "Condition selection at mode switching (b12 to b15)" of "[Pr.90] Operation setting for speed-torque control mode". Set "1: Zero speed ON condition invalid (for switching control mode)" only when switching the control mode without waiting for the servomotor to stop.

The history of control mode switching is stored to the start history at request of control mode switching. (☞ Page 468 System monitor data)

Confirm the control mode with "control mode ([Md.108] Servo status1: b2, b3)" of "[Md.108] Servo status". (☞ Page 477 Axis monitor data)

n: Axis No. - 1

| Monitor item | Buffer memory address |
|---|---|
| [Md.108] Servo status1: b2, b3 | 2477+100n |

## ■Precautions at control mode switching

- The start complete signal and the positioning complete signal do not turn ON at control mode switching.
- When "30: Control mode switch", "31: Speed control", or "32: Torque control" is set in "[Md.26] Axis operation status", the BUSY signal turns ON.
- The motor speed might change momentarily at switching from the speed control mode to the torque control mode. Therefore, it is recommended that the control mode is switched from the speed control to the torque control after the servomotors stop.
- Use the continuous operation to torque control mode for the usage such as pressing a workpiece. Do not execute the continuous operation to torque control in the speed control mode. Otherwise, an unexpected operation might occur at switching to the position control mode.
- "In speed control flag" ([Md.31] Status: b0) does not turn ON during the speed control mode in the speed-torque control.

## ■Operation for "Position control mode ⇔ Speed control mode switching"

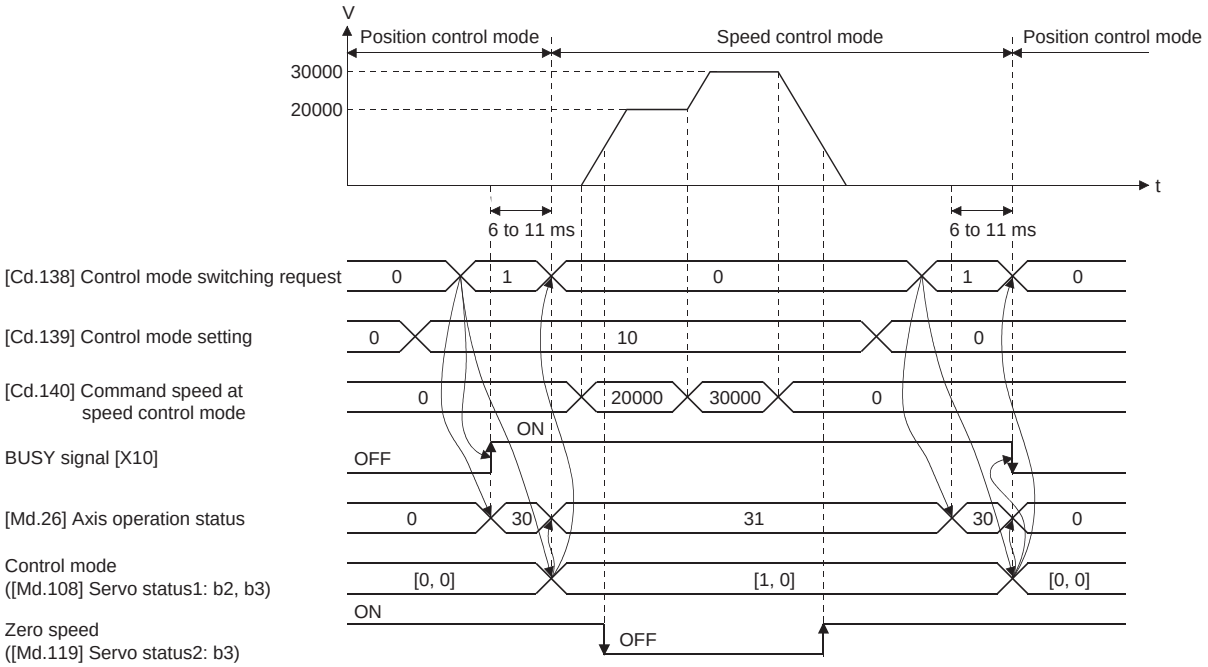
When the position control mode is switched to the speed control mode, the command speed immediately after the switching is the speed set in "speed initial value selection (b8 to b11)" of "[Pr.90] Operation setting for speed-torque control mode".

| Speed initial value selection ([Pr.90]: b8 to b11) | Command speed to servo amplifier immediately after switching from position control mode to speed control mode |
|---|---|
| 0: Command speed | The speed to servo amplifier immediately after switching is "0". |
| 1: Feedback speed | Motor speed received from servo amplifier at switching. |
| 2: Automatic selection | The command speed is invalid due to the setting of continuous operation to torque control mode. At control mode switching, operation is the same as "0: Command speed". |

When the speed control mode is switched to the position control mode, the command position immediately after the switching is the current feed value at switching.

The following chart shows the operation timing for axis 1.

## ■RD77MS4 operation example



## ■Operation for "Position control mode ⇔ Torque control mode switching"

When the position control mode is switched to the torque control mode, the command torque immediately after the switching is the torque set in "Torque initial value selection (b4 to b7)" of "[Pr.90] Operation setting for speed-torque control mode".

| Torque initial value selection ([Pr.90]: b4 to b7) | Command torque to servo amplifier immediately after switching from position control mode to torque control mode |
|---|---|
| 0: Command torque | The value of "[Cd.143] Command torque at torque control mode" at switching. |
| 1: Feedback torque | Motor torque value at switching. |

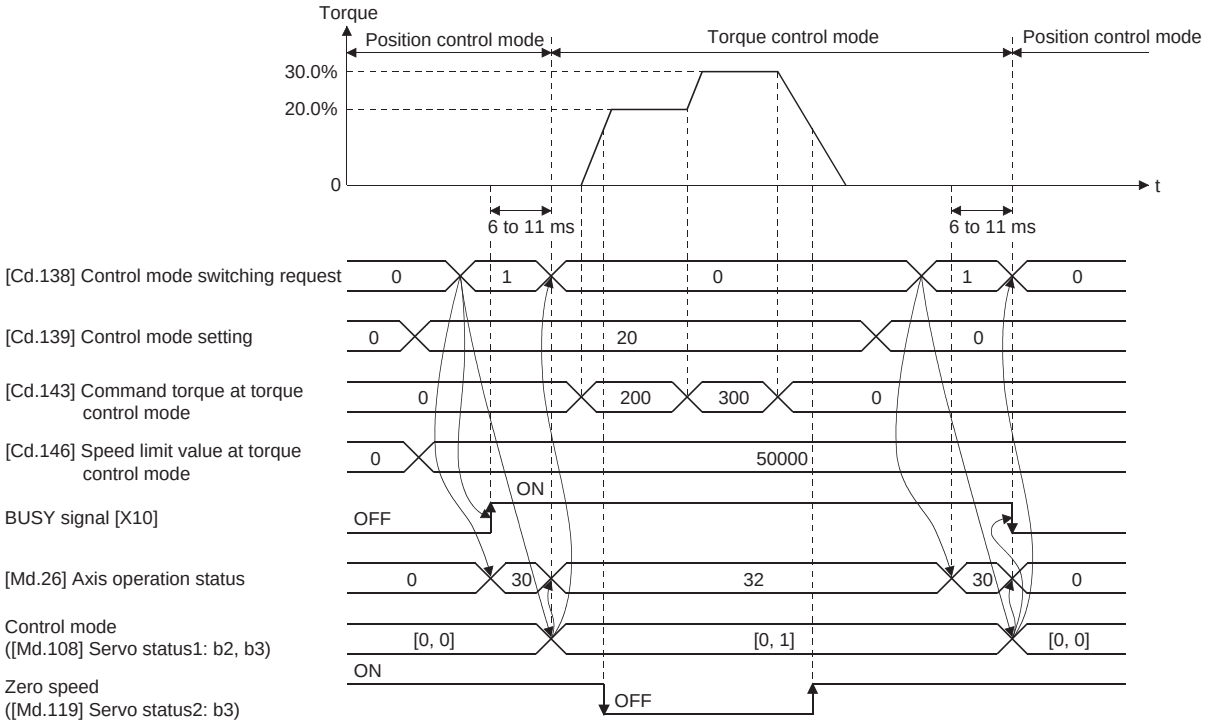
**Point**

When the servo parameter "Function selection C-B POL reflection selection at torque control (PC29)" is set to "0: Enabled" and "Torque initial value selection" is set to "1: Feedback torque", the warning "Torque initial value selection invalid" (warning code: 09E5H) will occur at control mode switching, and the command value immediately after switching is the same as the case of selecting "0: Command torque". If the feedback torque is selected, set "1: Disabled" in the servo parameter "Function selection C-B POL reflection selection at torque control (PC29)".

When the torque control mode is switched to the position control mode, the command position immediately after the switching is the current feed value at switching.

The following chart shows the operation timing for axis 1.

## ■RD77MS4 operation example



## ■Operation for "Speed control mode ⇔ Torque control mode switching"

When the speed control mode is switched to the torque control mode, the command torque immediately after the switching is the torque set in "Torque initial value selection (b4 to b7)" of "[Pr.90] Operation setting for speed-torque control mode".

| Torque initial value selection ([Pr.90]: b4 to b7) | Command torque to servo amplifier immediately after switching from speed control mode to torque control mode |
|---|---|
| 0: Command torque | The value of "[Cd.143] Command torque at torque control mode" at switching. |
| 1: Feedback torque | Motor torque value at switching. |

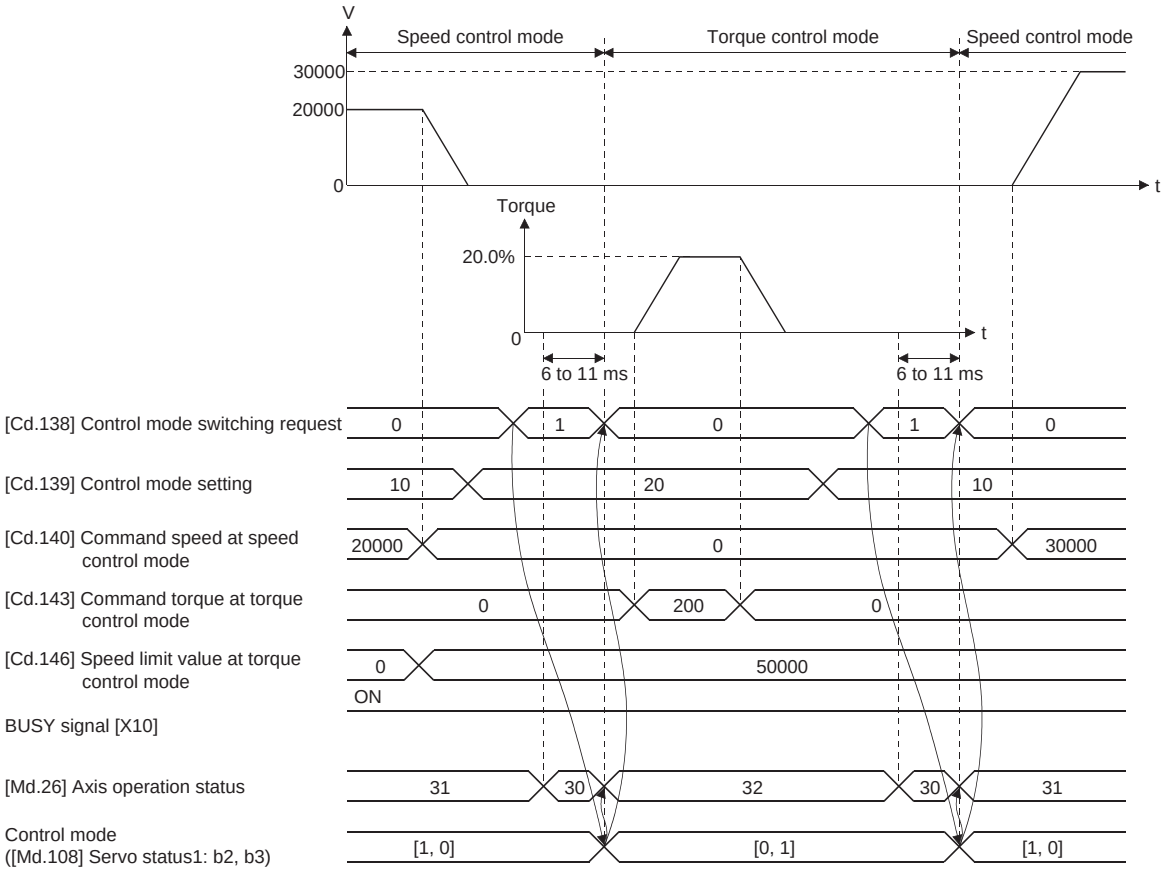
**Point**

When the servo parameter "Function selection C-B POL reflection selection at torque control (PC29)" is set to "0: Enabled" and "Torque initial value selection" is set to "1: Feedback torque", the warning "Torque initial value selection invalid" (warning code: 09E5H) will occur at control mode switching, and the command value immediately after switching is the same as the case of selecting "0: Command torque". If the feedback torque is selected, set "1: Disabled" in the servo parameter "Function selection C-B POL reflection selection at torque control (PC29)".

When the torque control mode is switched to the speed control mode, the command speed immediately after the switching is the motor speed at switching.

The following chart shows the operation timing for axis 1.

## ■RD77MS4 operation example



## Switching of control mode (Continuous operation to torque control)

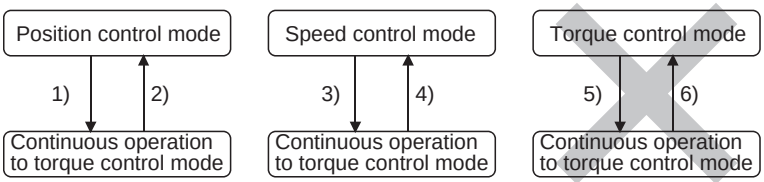
### ■Switching method of control mode

To switch the control mode to the continuous operation to torque control mode, set "1" in "[Cd.138] Control mode switching request" after setting the control mode to switch to "[Cd.139] Control mode setting" (30: Continuous operation to torque control mode) from position control mode or speed control mode.

The selected control mode can be checked in "[Md.26] Axis operation status".

When the switching condition is satisfied at control mode switching request, "1: Position control mode - continuous operation to torque control mode, speed control mode - continuous operation to torque control mode switching" is set in "[Md.124] Control mode switching status", and the BUSY signal turns ON.

The following shows the switching condition of the continuous operation to torque control mode.




| Switching operation | | Switching condition |
|---|---|---|
| 1) | Position control mode → Continuous operation to torque control mode | Not during positioning[*1] or during following positioning/synchronous mode<br>• ABS1: 1-axis linear control (ABS)<br>• INC1: 1-axis linear control (INC)<br>• FEED1: 1-axis fixed-feed control<br>• VF1: 1-axis speed control (Forward)<br>• VR1: 1-axis speed control (Reverse)<br>• VPF: Speed-position switching control (Forward)<br>• VPR: Speed-position switching control (Reverse)<br>• PVF: Position-speed switching control (Forward)<br>• PVR: Position-speed switching control (Reverse)<br>• Synchronous control |
| 2) | Continuous operation to torque control mode → Position control mode | During motor stop[*2] |
| 3) | Speed control mode → Continuous operation to torque control mode | None |
| 4) | Continuous operation to torque control mode → Speed control mode | |
| 5) | Torque control mode → Continuous operation to torque control mode | Switching is impossible. |
| 6) | Continuous operation to torque control mode → Torque control mode | |

*1 BUSY signal is OFF.

*2 ZERO speed ([Md.119] Servo status2: b3) is ON. The control mode can be changed without checking the switching condition of "during motor stop" in Simple Motion module by setting "1: Zero speed ON condition invalid (for switching control mode)" in "Condition selection at mode switching (b12 to b15)" of "[Pr.90] Operation setting for speed-torque control mode". Set "1: Zero speed ON condition invalid (for switching control mode)" only when switching the control mode without waiting for the servomotor to stop.

n: Axis No. - 1

| Monitor item | Buffer memory address |
|---|---|
| [Md.119] Servo status2: b3 | 2476+100n |

The history of control mode switching is stored to the start history at request of control mode switching. (☞ Page 468 System monitor data)

Confirm the status of the continuous operation to torque control mode with "b14: Continuous operation to torque control mode" of "[Md.125] Servo status3". When the mode is switched to the continuous operation to torque control mode, the value in "control mode (b2, b3)" of "[Md.108] Servo status1" remains the same as before switching the control mode. (☞ Page 477 Axis monitor data)

n: Axis No. - 1

| Monitor item | Buffer memory address |
|---|---|
| [Md.108] Servo status1: b2, b3 | 2477+100n |

**Point**

- When the mode is switched from position control mode to continuous operation to torque control mode, only the switching from continuous operation to torque control mode to position control mode is possible. If the mode is switched to other control modes, the warning "Control mode switching not possible" (warning code: 09EBH) will occur, and the control mode is not switched.
- When the mode is switched from speed control mode to continuous operation to torque control mode, only the switching from continuous operation to torque control mode to speed control mode is possible. If the mode is switched to other control modes, the warning "Control mode switching not possible" (warning code: 09EBH) will occur, and the control mode is not switched.

### ■Precautions at control mode switching

- The start complete signal and positioning complete signal do not turn ON at control mode switching.
- When "33: Continuous operation to torque control mode" is set in "[Md.26] Axis operation status" and "1: Position control mode - continuous operation to torque control mode, speed control mode - continuous operation to torque control mode switching" is set in "[Md.124] Control mode switching status", the BUSY signal turns ON.
- When using the continuous operation to torque control mode, use the servo amplifiers that are compatible with the continuous operation to torque control. If the servo amplifiers that are not compatible with the continuous operation to torque control are used, the error "Continuous operation to torque control not supported" (error code: 19E7H) occurs at request of switching to continuous operation to torque control mode, and the operation stops. (In the positioning control, the operation stops according to the setting of "[Pr.39] Stop group 3 sudden stop selection". In the speed control, the mode switches to the position control, and the operation immediately stops.)

### ■Operation for "Position control mode ⇔ Continuous operation to torque control mode switching"

To switch to the continuous operation to torque control mode, set the control data used in the control mode before setting "1" in "[Cd.138] Control mode switching request".

When the switching condition is satisfied at control mode switching request, "1: Position control mode - continuous operation to torque control mode, speed control mode - continuous operation to torque control mode switching" is set in "[Md.124] Control mode switching status" and the BUSY signal turns ON. (When the control mode switching request is executed while the BUSY signal is ON, the BUSY signal does not turn OFF but stays ON at control mode switching.)

"0" is automatically stored in "[Cd.138] Control mode switching request" and "[Md.124] Control mode switching status" after completion of switching.

When the position control mode is switched to the continuous operation to torque control mode, the command torque and command speed immediately after the switching are the values set according to the following setting in "Torque initial value selection (b4 to b7)" and "Speed initial value selection (b8 to b11)" of "[Pr.90] Operation setting for speed-torque control mode".

| Torque initial value selection ([Pr.90]: b4 to b7) | Command torque to servo amplifier immediately after switching from position control mode to continuous operation to torque control mode |
|---|---|
| 0: Command torque | The value of "[Cd.150] Target torque at continuous operation to torque control mode" at switching. |
| 1: Feedback torque | Motor torque value at switching. |

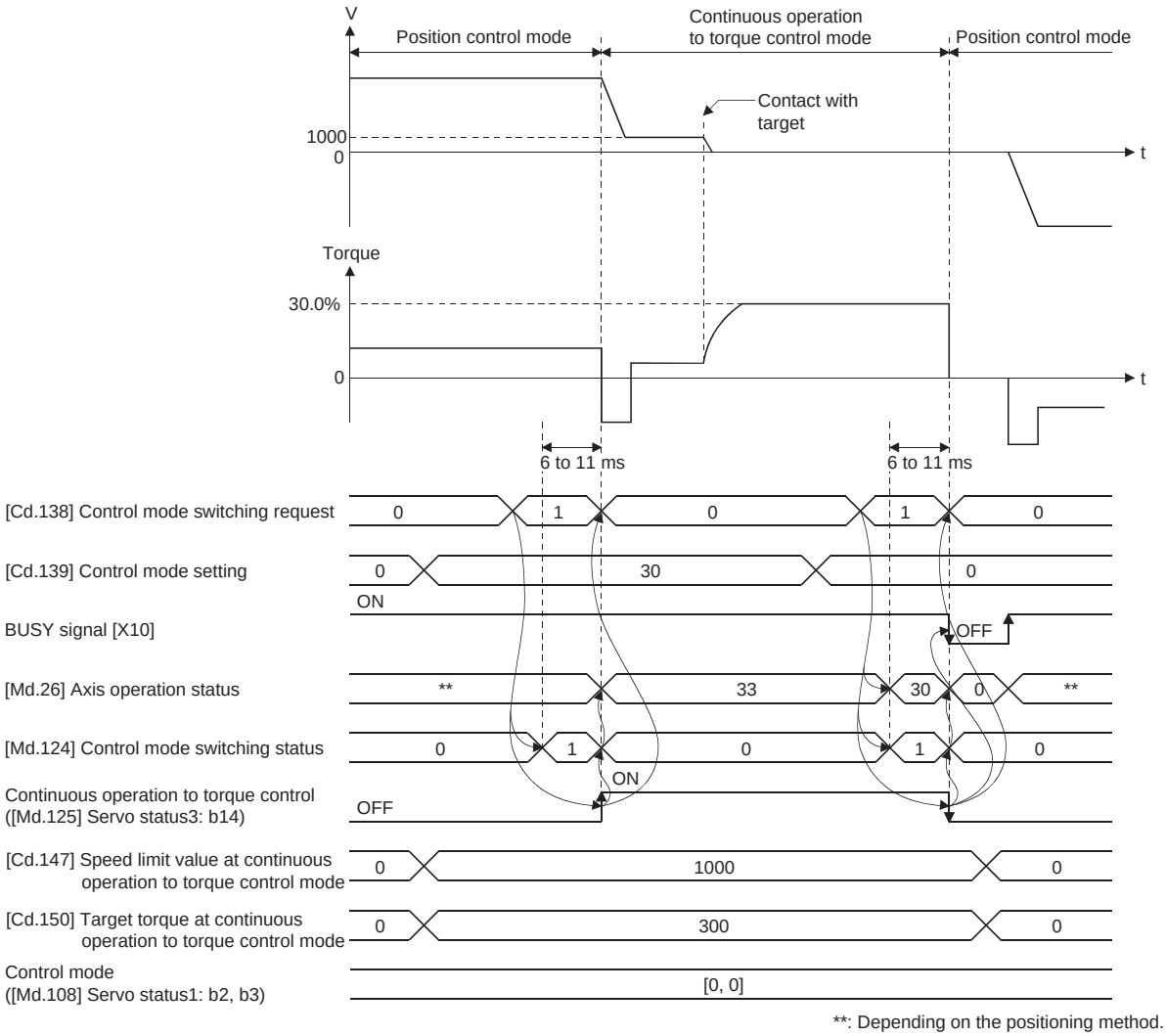
| Speed initial value selection ([Pr.90]: b8 to b11) | Command speed to servo amplifier immediately after switching from position control mode to continuous operation to torque control mode |
|---|---|
| 0: Command speed | Speed that the position command at switching is converted into the motor speed.<br>(When the positioning does not start at switching, the speed to servo amplifier immediately after switching is "0".) |
| 1: Feedback speed | Motor speed received from servo amplifier at switching. |
| 2: Automatic selection | The lower speed between speed that position command at switching is converted into the motor speed and motor speed received from servo amplifier at switching. |

**Point**

When the mode is switched to continuous operation to torque control mode in cases where command speed and actual speed are different such as during acceleration/deceleration or when the speed does not reach command speed due to torque limit, set "1: Feedback speed" in "Speed initial value selection (b8 to b11)".

The following chart shows the operation timing for axis 1.

## ■RD77MS4 operation example




**: Depending on the positioning method.

## ■Operation for "Speed control mode ⇔ Continuous operation to torque control mode switching"

To switch to the continuous operation to torque control mode, set the control data used in the control mode before setting "1" in "[Cd.138] Control mode switching request".

When the switching condition is satisfied at control mode switching request, "1: Position control mode - continuous operation to torque control mode, speed control mode - continuous operation to torque control mode switching" is set in "[Md.124] Control mode switching status" and the BUSY signal turns ON. (When the control mode switching request is executed while the BUSY signal is ON, the BUSY signal does not turn OFF but stays ON at control mode switching.)

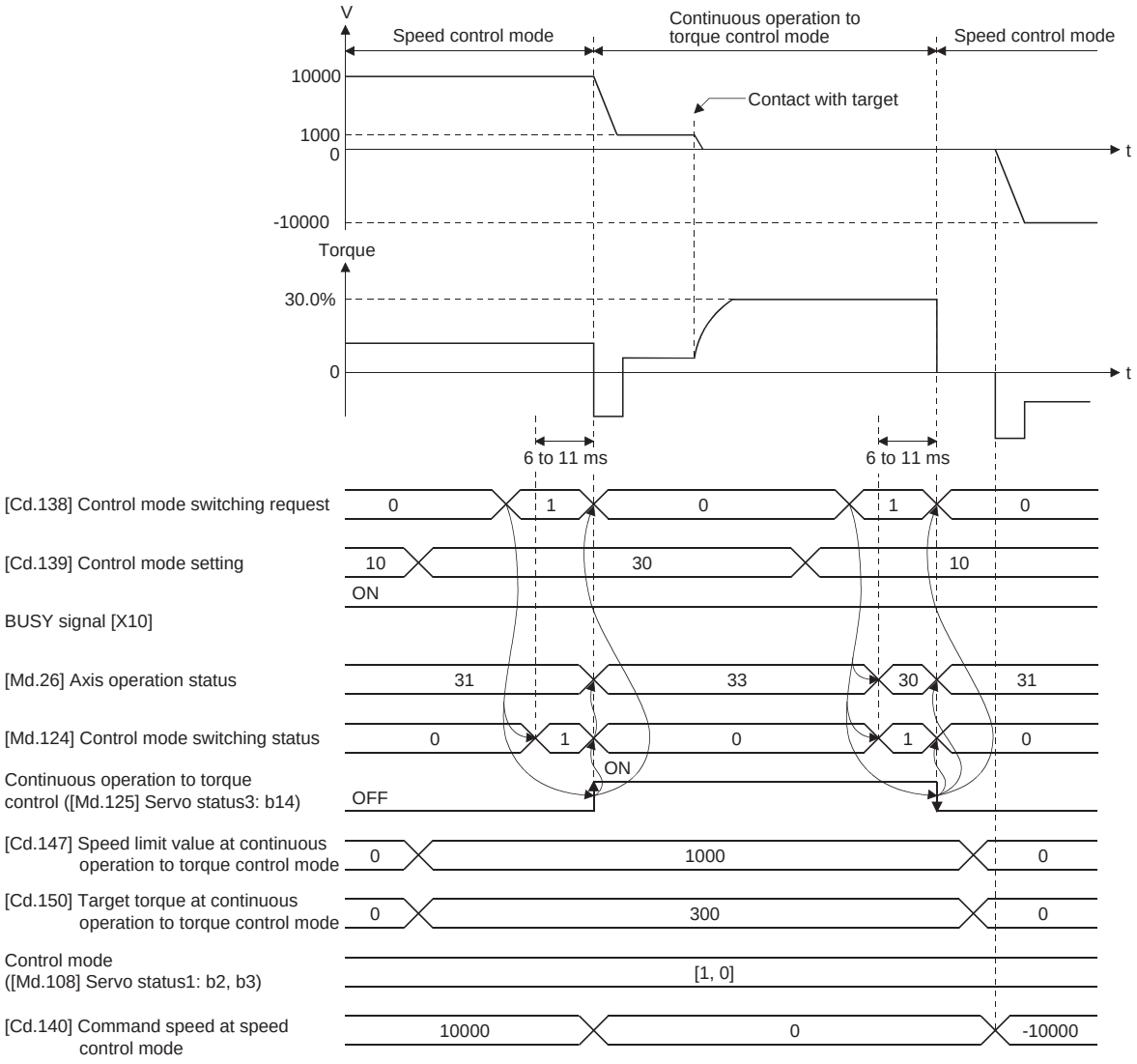
"0" is automatically stored in "[Cd.138] Control mode switching request" and "[Md.124] Control mode switching status" after completion of switching.

When the speed control mode is switched to the continuous operation to torque control mode, the command torque immediately after the switching is the torque set in "Torque initial value selection (b4 to b7)" of "[Pr.90] Operation setting for speed-torque control mode".

| Torque initial value selection ([Pr.90]: b4 to b7) | Command torque to servo amplifier immediately after switching from speed control mode to continuous operation to torque control mode |
|---|---|
| 0: Command torque | The value of "[Cd.150] Target torque at continuous operation to torque control mode" at switching. |
| 1: Feedback torque | Motor torque value at switching. |

The following chart shows the operation timing for axis 1.

## ■RD77MS4 operation example



### ■Operation for switching from "Position control mode" to "Continuous operation to torque control mode" automatically

To switch to the continuous operation to torque control mode automatically when the conditions set in "[Cd.153] Control mode auto-shift selection" and "[Cd.154] Control mode auto-shift parameter" are satisfied, set the control data necessary in the continuous operation to torque control mode, "[Cd.153] Control mode auto-shift selection" and "[Cd.154] Control mode auto-shift parameter", and then set "30: Continuous operation to torque control mode" in "[Cd.139] Control mode setting" and "1: Switching request" in "[Cd.138] Control mode switching request".

In this case, the current control is continued until the setting condition is satisfied after control mode switching request, and "2: Waiting for the completion of control mode switching condition" is set in "[Md.124] Control mode switching status". When the set condition is satisfied, "1: Position control mode - continuous operation to torque control mode, speed control mode - continuous operation to torque control mode switching" is set in "[Md.124] Control mode switching status".

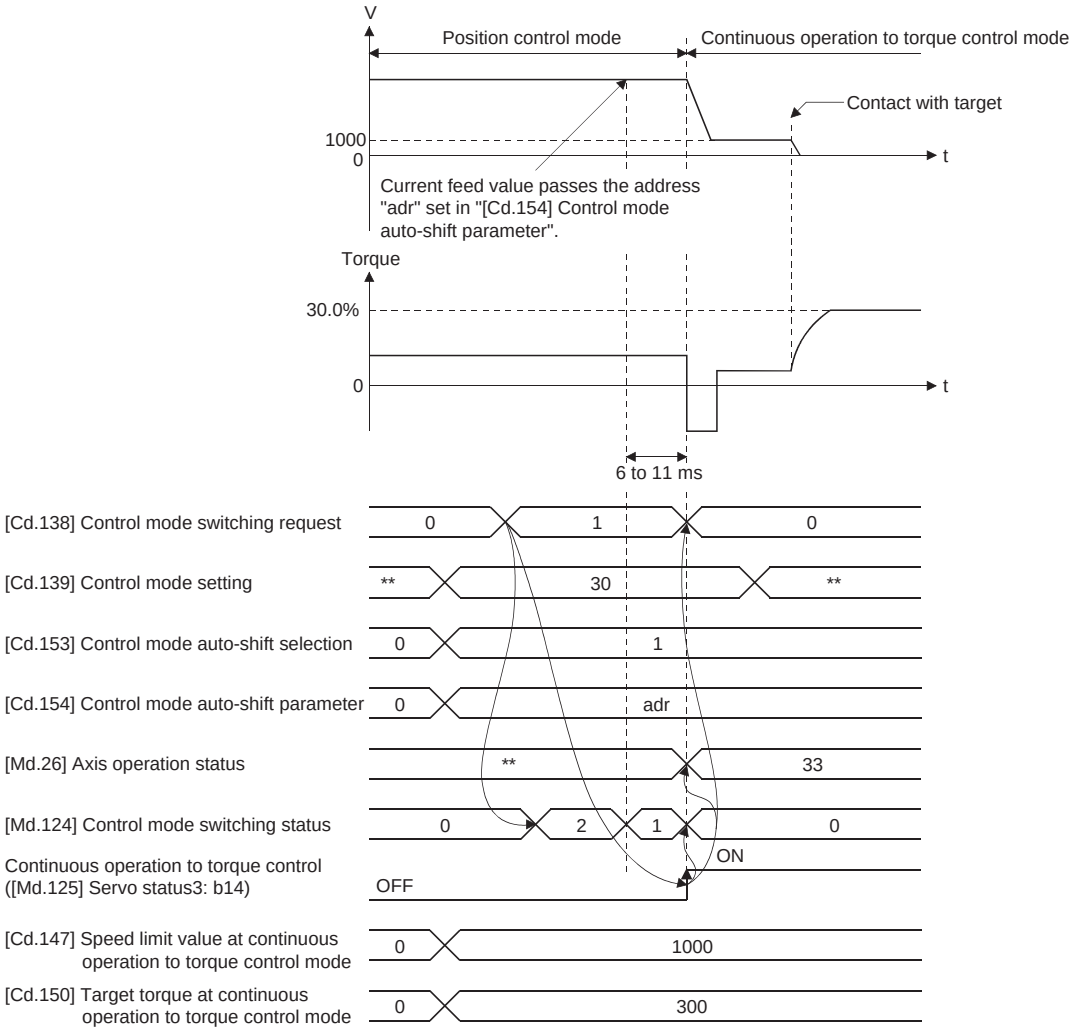
"0" is stored in "[Cd.138] Control mode switching request" and "[Md.124] Control mode switching status" after completion of switching.

If "[Cd.154] Control mode auto-shift parameter" is outside the setting range, the error "Outside control mode auto-shift switching parameter range" (error code: 19E4H) occurs at control mode switching request, and the current processing stops. (In the positioning control, the operation stops according to the setting of "[Pr.39] Stop group 3 sudden stop selection". In the speed control, the mode switches to the position control, and the operation immediately stops.)

**Point**

- Automatic switching is valid only when the control mode is switched from the position control mode to the continuous operation to torque control mode. When the mode is switched from speed control mode to continuous operation to torque control mode or from continuous operation to torque control mode to other control modes, even if the automatic switching is set, the state is not waiting for the completion of condition, and control mode switching is executed immediately.
- When the mode switching request is executed after setting the switching condition, the state of waiting for the completion of control mode switching condition continues until the setting condition is satisfied. Therefore, if the positioning by automatic switching is interrupted, unexpected control mode switching may be executed in other positioning operations. Waiting for the completion of control mode switching condition can be cancelled by setting "Other than 1: Not request" in "[Cd.138] Control mode switching request" or by turning the axis stop signal ON. When an error occurs, waiting for the completion of control mode switching condition is also cancelled. (In both cases, "0" is stored in "[Cd.138] Control mode switching request".)
- In the state of waiting for the completion of control mode switching condition, if the current values are updated by the current value changing, the fixed-feed control or the speed control (when "2: Clear current feed value to zero" is set in "[Pr.21] Current feed value during speed control"), an auto-shift judgment is executed based on the updated current value. Therefore, depending on the setting condition, the mode may be switched to the continuous operation to torque control mode immediately after the positioning starts. To avoid this switching, set "1: Switching request" in "[Cd.138] Control mode switching request".

The following chart shows the operation when "1: Current feed value pass" is set in "[Cd.153] Control mode auto-shift selection".




**: Depending on the control mode.

## Speed control mode

### ■Operation for speed control mode

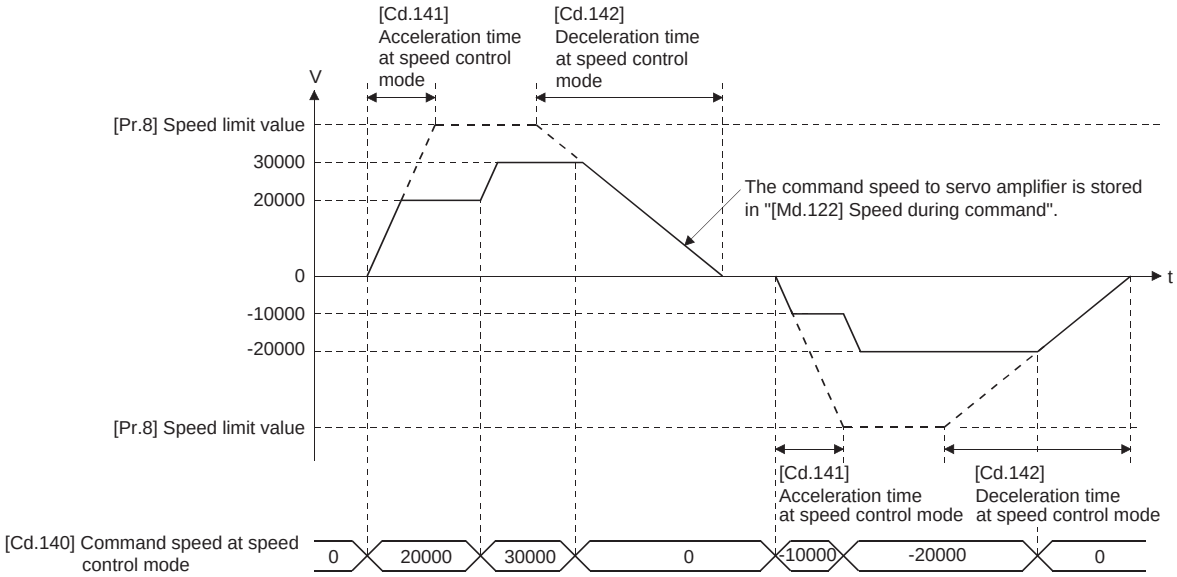
The speed control is executed at the speed set in "[Cd.140] Command speed at speed control mode" in the speed control mode.

Set a positive value for forward rotation and a negative value for reverse rotation. "[Cd.140]" can be changed any time during the speed control mode.

Acceleration/deceleration is performed based on a trapezoidal acceleration/deceleration processing. Set acceleration/deceleration time toward "[Pr.8] Speed limit value" in "[Cd.141] Acceleration time at speed control mode" and "[Cd.142] Deceleration time at speed control mode". The value at speed control mode switching request is valid for "[Cd.141]" and "[Cd.142]".

The command speed during the speed control mode is limited with "[Pr.8] Speed limit value". If the speed exceeding the speed limit value is set, the warning "Speed limit value over" (warning code: 0991H) occurs, and the operation is controlled with the speed limit value.

Confirm the command speed to servo amplifier with "[Md.122] Speed during command".




### ■Current feed value during speed control mode

"[Md.20] Current feed value", "[Md.21] Machine feed value" and "[Md.101] Real current value" are updated even in the speed control mode.

If the current feed value exceeds the software stroke limit, the error "Software stroke limit +" (error code: 1993H) or "Software stroke limit -" (error code: 1995H) occurs and the operation switches to the position control mode. Invalidate the software stroke limit to execute one-way feed.

## ■Stop cause during speed control mode

The operation for stop cause during speed control mode is shown below.

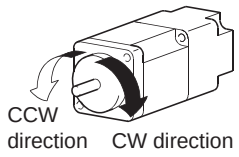
| Item | Operation during speed control mode |
|---|---|
| "[Cd.180] Axis stop" turned ON. | The motor decelerates to speed "0" according to the setting value of "[Cd.142] Deceleration time at speed control mode". The mode switches to the position control mode when "Zero speed" of "[Md.119] Servo status2" turns ON, and the operation stops. |
| Stop signal of "[Cd.44] External input signal operation device (Axis 1 to 16)" turned ON. | |
| All axis servo ON [Y1] turned OFF. | The servo OFF is not executed during the speed control mode. The command status when the mode is switched to the position control mode becomes valid. |
| "[Cd.100] Servo OFF command" turned ON. | |
| The current value reached the software stroke limit. | An error (error code: 1900H, 1904H to 1907H, 1993H, 1995H) occurs. The mode switches to the position control mode at the current position, and the operation immediately stops. (Deceleration processing is not executed.) |
| The position of the motor reached the hardware stroke limit | |
| PLC READY [Y0] turned OFF. | |
| The forced stop input to Simple Motion module. | The mode switches to the position control mode when the servo OFF (Servo ON of "[Md.108] Servo status1" turns OFF) is executed. (While the servo amplifier is servo OFF, even if the mode is switched to position control mode, the servomotor occurs to the free run. (The operation stops with dynamic brake.)) |
| The emergency stop input to servo amplifier. | |
| The servo error occurred. | |
| The servo amplifier's power supply turned OFF. | The motor occurs to the free run. (The operation stops with dynamic brake.) (The mode is set to the position control mode at the servo amplifier's power supply ON again.) |

## ■Operation for torque control mode

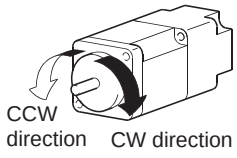
The torque control is executed at the command torque set in "[Cd.143] Command torque at torque control mode" in the torque control mode.

"[Cd.143] Command torque at torque control mode" can be changed any time during torque control mode. The relation between the setting of command torque and the torque generation direction of servomotor varies depending on the setting of servo parameters "Rotation direction selection/travel direction selection (PA14)" and "Function selection C-B POL reflection selection at torque control (PC29)".

• When servo parameter "Function selection C-B POL reflection selection at torque control (PC29)" is set to "0: Enabled"

| "Rotation direction selection/ travel direction selection (PA14)" | "[Cd.143] Command torque at torque control mode" | Torque generation direction of servo motor | |
|---|---|---|---|
| 0: Forward rotation (CCW) with the increase of the positioning address | Positive value (Forward direction) | CCW direction |  |
| | Negative value (Reverse direction) | CW direction | |
| 1: Reverse rotation (CW) with the increase of the positioning address | Positive value (Forward direction) | CW direction | |
| | Negative value (Reverse direction) | CCW direction | |

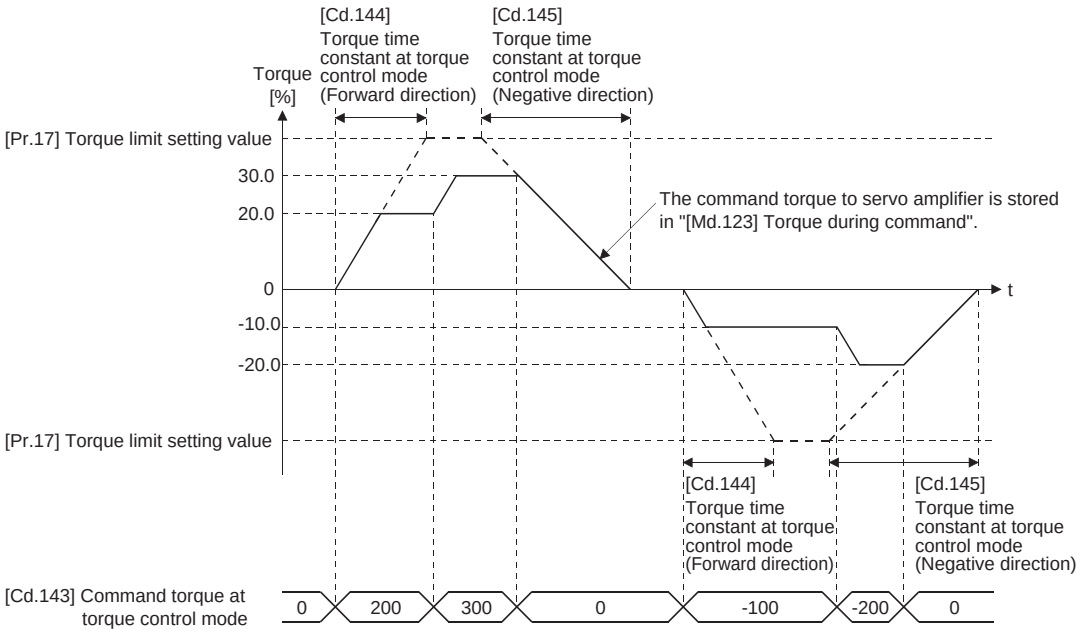
• When servo parameter "Function selection C-B POL reflection selection at torque control (PC29)" is set to "1: Disabled"

| "Rotation direction selection/ travel direction selection (PA14)" | "[Cd.143] Command torque at torque control mode" | Torque generation direction of servo motor | |
|---|---|---|---|
| 0: Forward rotation (CCW) with the increase of the positioning address | Positive value (Forward direction) | CCW direction |  |
| | Negative value (Reverse direction) | CW direction | |
| 1: Reverse rotation (CW) with the increase of the positioning address | Positive value (Forward direction) | CCW direction | |
| | Negative value (Reverse direction) | CW direction | |

Set time for the command torque to increase from 0% to "[Pr.17] Torque limit setting value" in "[Cd.144] Torque time constant at torque control mode (Forward direction)" and for the command torque to decrease from "[Pr.17] Torque limit setting value" to 0% in "[Cd.145] Torque time constant at torque control mode (Negative direction)". The value at torque control mode switching request is valid for "[Cd.144]" and "[Cd.145]".

The command torque during the torque control mode is limited with "[Pr.17] Torque limit setting value". If the torque exceeding the torque limit setting value is set, the warning "Torque limit value over" (warning code: 09E4H) occurs, and the operation is controlled with the torque limit setting value.

Confirm the command torque to servo amplifier with "[Md.123] Torque during command".



## ■Speed during torque control mode

The speed during the torque control mode is controlled with "[Cd.146] Speed limit value at torque control mode". At this time, "Speed limit" ("[Md.119] Servo status2": b4) turns ON.

n: Axis No. - 1

| Monitor item | Buffer memory address |
|---|---|
| [Md.119] Servo status2: b4 | 2476+100n |

"[Cd.146] Speed limit value at torque control mode" is set to a positive value regardless of the rotation direction. (Controlled by the same value for forward and reverse directions.)

In addition, "[Cd.146] Speed limit value at torque control mode" is limited with "[Pr.8] Speed limit value". If the speed exceeding the speed limit value is set, the warning "Speed limit value over" (warning code: 0991H) occurs, and the operation is controlled with the speed limit value.

The acceleration/deceleration processing is invalid for "[Cd.146] Speed limit value at torque control mode".

**Point**

The actual motor speed may not reach the speed limit value depending on the machine load situation during the torque control.

## ■Current feed value during torque control mode

"[Md.20] Current feed value", "[Md.21] Machine feed value" and "[Md.101] Real current value" are updated even in the torque control mode.

If the current feed value exceeds the software stroke limit, the error "Software stroke limit +" (error code: 1993H) or "Software stroke limit -" (error code: 1995H) occurs and the operation switches to the position control mode. Invalidate the software stroke limit to execute one-way feed.

## ■Stop cause during torque control mode

The operation for stop cause during torque control mode is shown below.

| Item | Operation during torque control mode |
|---|---|
| "[Cd.180] Axis stop" turned ON. | The speed limit value commanded to servo amplifier is "0" regardless of the setting value of "[Cd.146] Speed limit value at torque control mode". The mode switches to the position control mode when "Zero speed" of "[Md.119] Servo status2" turns ON, and the operation immediately stops. (Deceleration processing is not executed.)<br>The value of command torque is not changed. It might take time to reach the speed "0" depending on the current torque command value. |
| Stop signal of "[Cd.44] External input signal operation device (Axis 1 to 16)" turned ON. | |
| All axis servo ON [Y1] turned OFF. | The servo OFF is not executed during the torque control mode. The command status when the mode is switched to the position control mode becomes valid. |
| "[Cd.100] Servo OFF command" turned ON. | |
| The current value reached the software stroke limit. | An error (error code: 1900H, 1904H to 1907H, 1993H, 1995H) occurs. The mode switches to the position control mode at the current position, and the operation immediately stops. (Deceleration processing is not executed.) |
| The position of the motor reached the hardware stroke limit | |
| PLC READY [Y0] turned OFF. | |
| The forced stop input to Simple Motion module. | The mode switches to the position control mode when the servo OFF (Servo ON of "[Md.108] Servo status1" turns OFF) is executed.<br>(While the servo amplifier is servo OFF, even if the mode is switched to position control mode, the servomotor occurs to the free run. (The operation stops with dynamic brake.)) |
| The emergency stop input to servo amplifier. | |
| The servo error occurred. | |
| The servo amplifier's power supply turned OFF. | The motor occurs to the free run. (The operation stops with dynamic brake.) (The mode is set to the position control mode at the servo amplifier's power supply ON again.) |

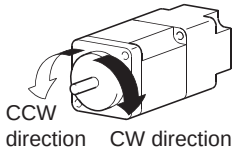
## Continuous operation to torque control mode

### ■Operation for continuous operation to torque control mode

In continuous operation to torque control, the torque control can be executed without stopping the operation during the positioning in position control mode or speed command in speed control mode.

During the continuous operation to torque control mode, the torque control is executed at the command torque set in "[Cd.150] Target torque at continuous operation to torque control mode" while executing acceleration/deceleration to reach the speed set in "[Cd.147] Speed limit value at continuous operation to torque control mode".

"[Cd.147] Speed limit value at continuous operation to torque control mode" and "[Cd.150] Target torque at continuous operation to torque control mode" can be changed any time during the continuous operation to torque control mode. The relation between the setting value of command torque and the torque generation direction of servomotor is fixed regardless of the setting of servo parameters "Rotation direction selection/travel direction selection (PA14)" and "Function selection C-B POL reflection selection at torque control (PC29)".

| "Rotation direction selection/ travel direction selection (PA14)" | "[Cd.150] Target torque at continuous operation to torque control mode" | Torque generation direction of servo motor | |
|---|---|---|---|
| 0: Forward rotation (CCW) with the increase of the positioning address | Positive value (Forward direction) | CCW direction |  |
| | Negative value (Reverse direction) | CW direction | |
| 1: Reverse rotation (CW) with the increase of the positioning address | Positive value (Forward direction) | CCW direction | |
| | Negative value (Reverse direction) | CW direction | |

**Restriction**

Regardless of the setting in "Rotation direction selection/travel direction selection (PA14)", set a positive value when torque command is in CCW direction of servomotor and a negative value when torque command is in CW direction of servomotor in "[Cd.150] Target torque at continuous operation to torque control mode".

If the setting is incorrect, the motor may rotate in an opposite direction.

**Point**

- The motor rotates in a direction according to the setting in "[Cd.150] Target torque at continuous operation to torque control mode". Set the value corresponding to the motor rotation direction in "[Cd.147] Speed limit value at continuous operation to torque control mode".
- Speed is not limited for reverse torque generation direction.

### ■Torque command setting method

During the continuous operation to torque control mode, set time for the command torque to increase from 0% to "[Pr.17] Torque limit setting value" in "[Cd.151] Torque time constant at continuous operation to torque control mode (Forward direction)" and for the command torque to decrease from "[Pr.17] Torque limit setting value" to 0% in "[Cd.152] Torque time constant at continuous operation to torque control mode (Negative direction)". The value at continuous operation to torque control mode switching request is valid for "[Cd.151]" and "[Cd.152]".

The command torque during the continuous operation to torque control mode is limited with "[Pr.17] Torque limit setting value".

If torque exceeding the torque limit setting value is commanded, the warning "Torque limit value over" (warning code: 09E4H) occurs, and the operation is controlled with the torque limit setting value.

Confirm the command torque to servo amplifier with "[Md.123] Torque during command".

During the continuous operation to torque control mode, "Torque limit" ("[Md.108] Servo status1": b13) does not turn ON.

Confirm the current torque value in "[Md.104] Motor current value".

n: Axis No. - 1

| Monitor item | Buffer memory address |
|---|---|
| [Md.108] Servo status1: b13 | 2477+100n |

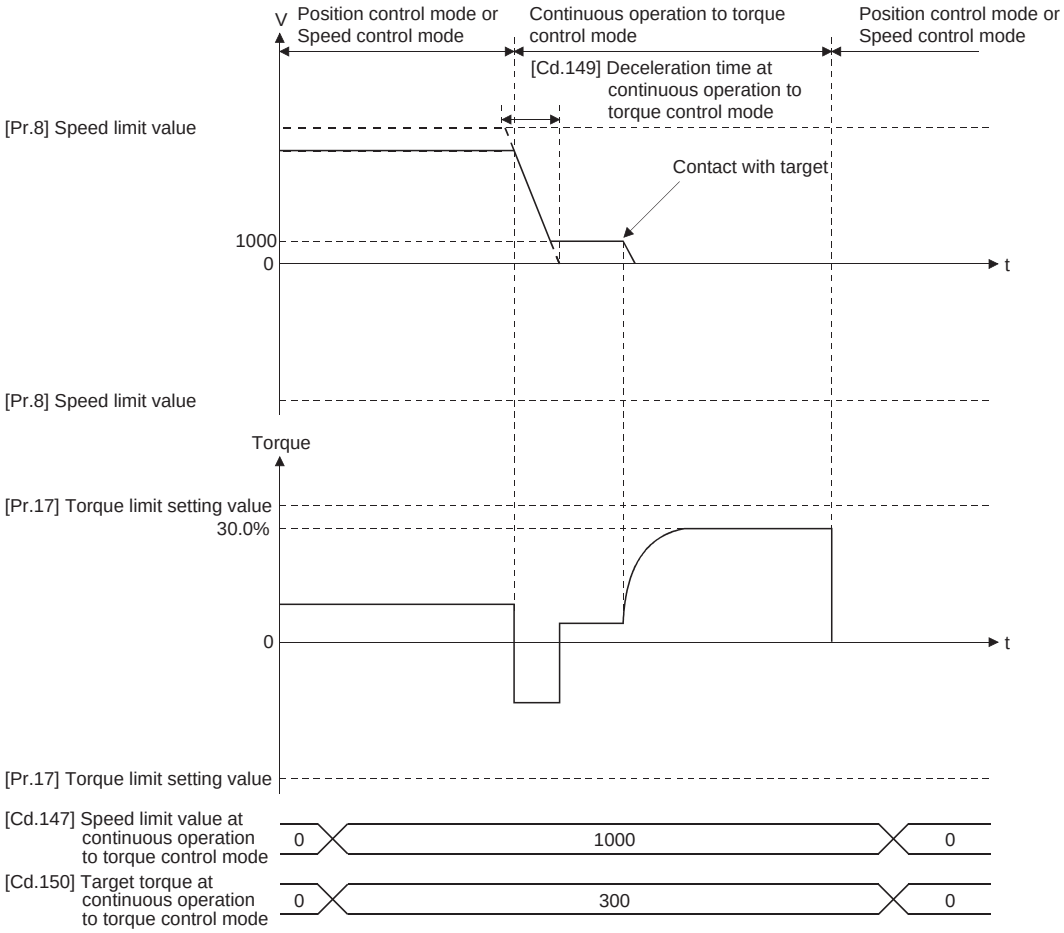
## ■Speed limit value setting method

Acceleration/deceleration is performed based on a trapezoidal acceleration/deceleration processing.

Set acceleration/deceleration time toward "[Pr.8] Speed limit value" in "[Cd.148] Acceleration time at continuous operation to torque control mode" and "[Cd.149] Deceleration time at continuous operation to torque control mode". The value at continuous operation to torque control mode switching is valid for "[Cd.148]" and "[Cd.149]".

"[Cd.147] Speed limit value at continuous operation to torque control mode" is limited with "[Pr.8] Speed limit value". If the speed exceeding the speed limit value is commanded, the warning "Speed limit value over" (warning code: 0991H) occurs, and the operation is controlled with the speed limit value.

Confirm the command speed to servo amplifier with "[Md.122] Speed during command".




## ■Precautions at continuous operation to torque control mode

The following functions of the servo amplifier are not available during the continuous operation to torque control mode.

- Base circuit shut-off delay time function
- Forced stop deceleration function
- Vertical axis freefall prevention function
- Driver communication function

## ■Speed during continuous operation to torque control mode

The speed during the continuous operation to torque control mode is controlled with an absolute value of the value set in "[Cd.147] Speed limit value at continuous operation to torque control mode" as command speed. When the speed reaches the absolute value of "[Cd.147] Speed limit value at continuous operation to torque control mode", "Speed limit" ("[Md.119] Servo status2": b4) turns ON.

n: Axis No. - 1

| Monitor item | Buffer memory address |
|---|---|
| [Md.119] Servo status2: b4 | 2476+100n |

In addition, "[Cd.147] Speed limit value at continuous operation to torque control mode" is limited with "[Pr.8] Speed limit value". If the command speed exceeding the speed limit value is set, the warning "Speed limit value over" (warning code: 0991H) occurs, and the operation is controlled with the speed limit value.

**Point**

The actual motor speed may not reach the command speed depending on the machine load situation during the continuous operation to torque control mode.

## ■Current feed value during continuous operation to torque control mode

"[Md.20] Current feed value", "[Md.21] Machine feed value" and "[Md.101] Real current value" are updated even in the continuous operation to torque control mode.

If the current feed value exceeds the software stroke limit, the error "Software stroke limit +" (error code: 1993H) or "Software stroke limit -" (error code: 1995H) occurs and the operation switches to the position control mode. Invalidate the software stroke limit to execute one-way feed.

## ■Stop cause during continuous operation to torque control mode

The operation for stop cause during continuous operation to torque control mode is shown below.

| Item | Operation during continuous operation to torque control mode |
|---|---|
| "[Cd.180] Axis stop" turned ON. | The speed limit value commanded to servo amplifier is "0" regardless of the setting value of "[Cd.147] Speed limit value at continuous operation to torque control mode". The mode switches to the position control mode when "Zero speed" of "[Md.119] Servo status2" turns ON, and the operation immediately stops. (Deceleration processing is not executed.)<br>The value of command torque is not changed. It might take time to reach the speed "0" depending on the current torque command value. |
| Stop signal of "[Cd.44] External input signal operation device (Axis 1 to 16)" turned ON. | |
| All axis servo ON [Y1] turned OFF. | The servo OFF is not executed during the continuous operation to torque control mode. The command status when the mode is switched to the position control mode becomes valid. |
| "[Cd.100] Servo OFF command" turned ON. | |
| The current value reached the software stroke limit. | An error (error code: 1900H, 1904H to 1907H, 1993H, 1995H) occurs. The mode switches to the position control mode at the current position, and the operation immediately stops. (Deceleration processing is not executed.)*1<br>When the operation immediately stops, the motor may start hunting depending on the motor speed. Therefore, be sure not to reach the limit in high speed and not to turn OFF the PLC READY. |
| The position of the motor reached the hardware stroke limit | |
| PLC READY [Y0] turned OFF. | |
| The forced stop input to Simple Motion module. | The mode switches to the position control mode when the servo OFF (Servo ON of "[Md.108] Servo status1" turns OFF) is executed.*1<br>(While the servo amplifier is servo OFF, even if the mode is switched to position control mode, the servomotor occurs to the free run (The operation stops with dynamic brake).) |
| The emergency stop input to servo amplifier. | |
| The servo error occurred. | |
| The servo amplifier's power supply turned OFF. | The motor occurs to the free run (The operation stops with dynamic brake.). (The mode is set to the position control mode at the servo amplifier's power supply ON again.) |

*1 When the mode has switched from the speed control mode to the continuous operation to torque control mode, the mode switches to the position control mode after switching the speed control mode once. Therefore, it takes the following time to switch to the position control mode.
Switching time for the speed control mode + Switching time for the position control mode

# 7.2 Synchronous Control

"Synchronous control" can be achieved using software instead of controlling mechanically with gear, shaft, speed change gear or cam, etc.
"Synchronous control" synchronizes movement with the input axis (servo input axis or synchronous encoder axis), by setting "the parameters for synchronous control" and starting synchronous control on each output axis.
Refer to the following for details of synchronous control.
MELSEC iQ-R Simple Motion Module User's Manual (Advanced Synchronous Control)

# 8 CONTROL SUB FUNCTIONS

The details and usage of the "sub functions" added and used in combination with the main functions are explained in this chapter.
A variety of sub functions are available, including functions specifically for machine home position return and generally related functions such as control compensation, etc. More appropriate, finer control can be carried out by using these sub functions. Each sub function is used together with a main function by creating matching parameter settings and programs. Read the execution procedures and settings for each sub function, and set as required.

## 8.1 Outline of Sub Functions

"Sub functions" are functions that compensate, limit, add functions, etc., to the control when the main functions are executed. These sub functions are executed by parameter settings, operation from the engineering tool, sub function programs, etc.

### Outline of sub functions

The following table shows the types of sub functions available.

| Sub function | | Details |
|---|---|---|
| Functions characteristic to machine home position return | Home position return retry function | This function retries the home position return with the upper/lower limit switches during machine home position return. This allows machine home position return to be carried out even if the axis is not returned to before the near-point dog with JOG operation, etc. |
| | Home position shift function | After returning to the machine home position, this function offsets the position by the designated distance from the machine home position and sets that position as the home position address. |
| Functions that compensate control | Backlash compensation function | This function compensates the mechanical backlash. Feed command equivalent to the set backlash amount are output each time the movement direction changes. |
| | Electronic gear function | By setting the movement amount per pulse, this function can freely change the machine movement amount per commanded pulse.<br>When the movement amount per pulse is set, a flexible positioning system that matches the machine system can be structured. |
| | Near pass function *1 | This function suppresses the machine vibration when the speed is changed during continuous path control in the interpolation control. |
| Functions that limit control | Speed limit function | If the command speed exceeds "[Pr.8] Speed limit value" during control, this function limits the commanded speed to within the "[Pr.8] Speed limit value" setting range. |
| | Torque limit function | If the torque generated by the servomotor exceeds "[Pr.17] Torque limit setting value" during control, this function limits the generated torque to within the "[Pr.17] Torque limit setting value" setting range. |
| | Software stroke limit function | If a command outside of the upper/lower limit stroke limit setting range, set in the parameters, is issued, this function will not execute positioning for that command. |
| | Hardware stroke limit function | This function carries out deceleration stop with the hardware stroke limit switch. |
| | Forced stop function | This function stops the all axes of the servo amplifier when the forced stop input signal of the Simple Motion module external input connection connector is turned ON. |
| Functions that change control details | Speed change function | This function changes the speed during positioning.<br>Set the changed speed in the speed change buffer memory ([Cd.14] New speed value), and change the speed with the speed change request ([Cd.15] Speed change request). |
| | Override function | This function changes the speed within a percentage of 0 to 300% during positioning. This is executed using "[Cd.13] Positioning operation speed override". |
| | Acceleration/deceleration time change function | This function changes the acceleration/deceleration time during speed change. |
| | Torque change function | This function changes the "torque limit value" during control. |
| | Target position change function | This function changes the target position during the execution of positioning. At the same time, this also can change the speed. |
| Functions related to positioning start | Pre-reading start function | This function shortens the virtual start time. |
| Absolute position system function | | This function restores the absolute position of designated axis. |

| Sub function | | Details |
|---|---|---|
| Functions related to positioning stop | Stop command processing for deceleration stop function | This function selects a deceleration curve when a stop cause occurs during deceleration stop processing to speed 0. |
| | Continuous operation interrupt function | This function interrupts continuous operation. When this request is accepted, the operation stops when the execution of the current positioning data is completed. |
| | Step function | This function temporarily stops the operation to confirm the positioning operation during debugging, etc.<br>The operation can be stopped at each "automatic deceleration" or "positioning data". |
| Other functions | Skip function | This function stops the positioning being executed (decelerates to a stop) when the skip signal is input, and carries out the next positioning. |
| | M code output function | This function issues a sub work (clamp or drill stop, tool change, etc.) according to the code No. (0 to 65535) set for each positioning data.<br>The M code output timing can be set for each positioning data. |
| | Teaching function | This function stores the address positioned with manual control into the positioning address ([Da.6] Positioning address/movement amount) having the designated positioning data No. |
| | Command in-position function | This function calculates the remaining distance for the Simple Motion module to reach the positioning stop position, and when the value is less than the set value, sets the "command in-position flag". When using another sub work before ending the control, use this function as a trigger for the sub work. |
| | Acceleration/deceleration processing function | This function adjusts the control acceleration/deceleration. |
| | Deceleration start flag function | This function turns ON the flag when the constant speed status or acceleration status switches to the deceleration status during position control, whose operation pattern is "Positioning complete", to make the stop timing known. |
| | Follow up function | This function monitors the motor rotation amount with the servo turned OFF, and reflects it on the current feed value. |
| | Speed control 10 × multiplier setting for degree axis function | This function executes the positioning control by the 10 × speed of the command speed and the speed limit value when the setting unit is "degree". |
| | Operation setting for incompletion of home position return function | This function is provided to select whether positioning control is operated or not when the home position return request flag is ON. |

*1 The near pass function is validated only when the machine of the standard specification carries out the position control with the continuous path control mode. It cannot be invalidated with parameters.

# 8.2 Sub Functions Specifically for Machine Home Position Return

The sub functions specifically for machine home position return include the "home position return retry function" and "home position shift function". Each function is executed by parameter setting.

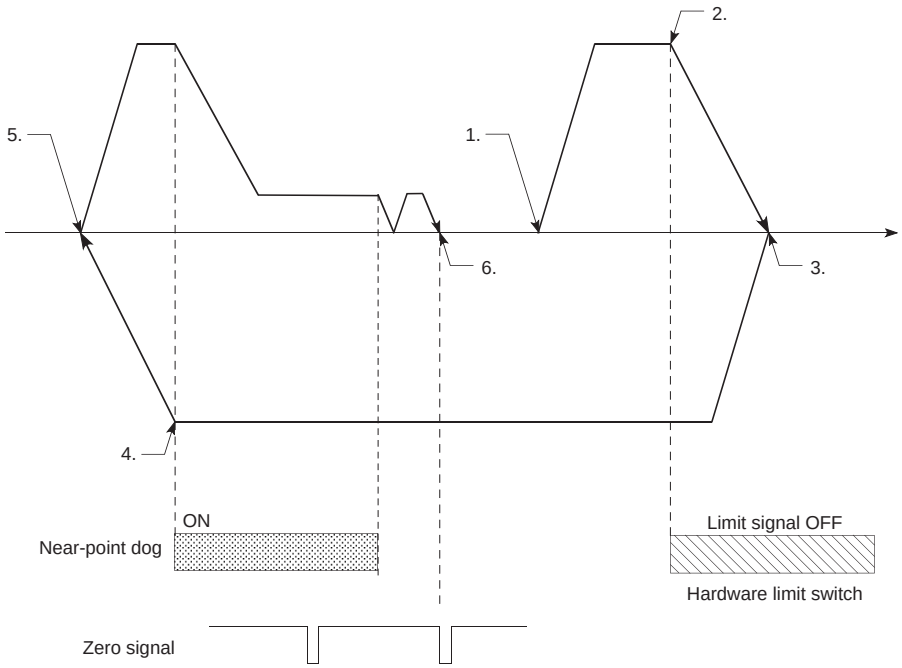
## Home position return retry function

When the workpiece goes past the home position without stopping during positioning control, it may not move back in the direction of the home position although a machine home position return is commanded, depending on the workpiece position. This normally means the workpiece has to be moved to a position before the near-point dog by a JOG operation, etc., to start the machine home position return again. However, by using the home position return retry function, a machine home position return can be carried out regardless of the workpiece position.

### Control details

The following drawing shows the operation of the home position return retry function.

**■Home position return retry point return retry operation when the workpiece is within the range between the upper and lower limits.**




***1.*** The movement starts in the "[Pr.44] Home position return direction" by a machine home position return start.

***2.*** The operation decelerates when the limit signal OFF is detected.

***3.*** After stopping due to the limit signal OFF detection, the operation moves at the "[Pr.46] Home position return speed" in the opposite direction of the "[Pr.44] Home position return direction".

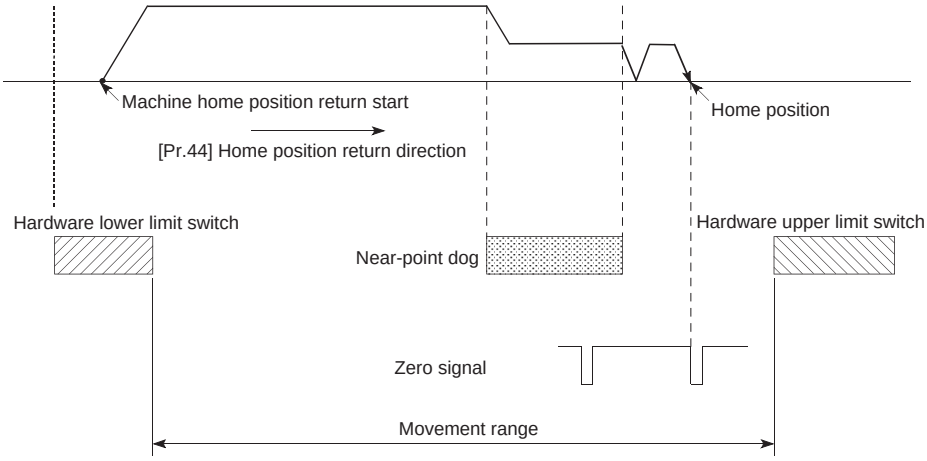
***4.*** The operation decelerates when the near-point dog turns OFF.

***5.*** After stopping due to the near-point dog OFF, a machine home position return is carried out in the "[Pr.44] Home position return direction".

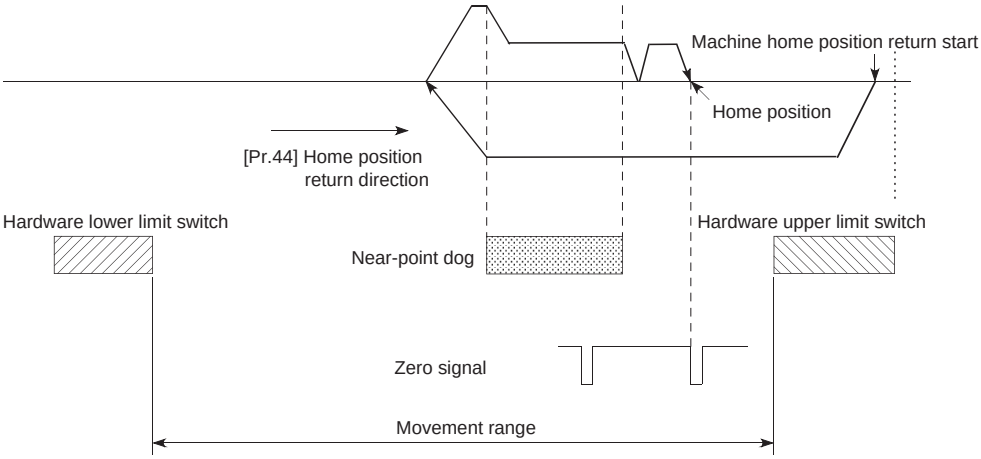
***6.*** Machine home position return completion

## ■Home position return retry operation when the workpiece is outside the range between the upper and lower limits.

- When the direction from the workpiece to the home position is the same as the "[Pr.44] Home position return direction", a normal machine home position return is carried out. The example shown below is for when "0: Positive direction" is set in "[Pr.44] Home position return direction".




- When the direction from the workpiece to the home position is the opposite direction from the "[Pr.44] Home position return direction", the operation carries out a deceleration stop when the near-point dog turns OFF, and then carries out a machine home position return in the direction set in "[Pr.44] Home position return direction". The example shown below is for when "0: Positive direction" is set in "[Pr.44] Home position return direction".

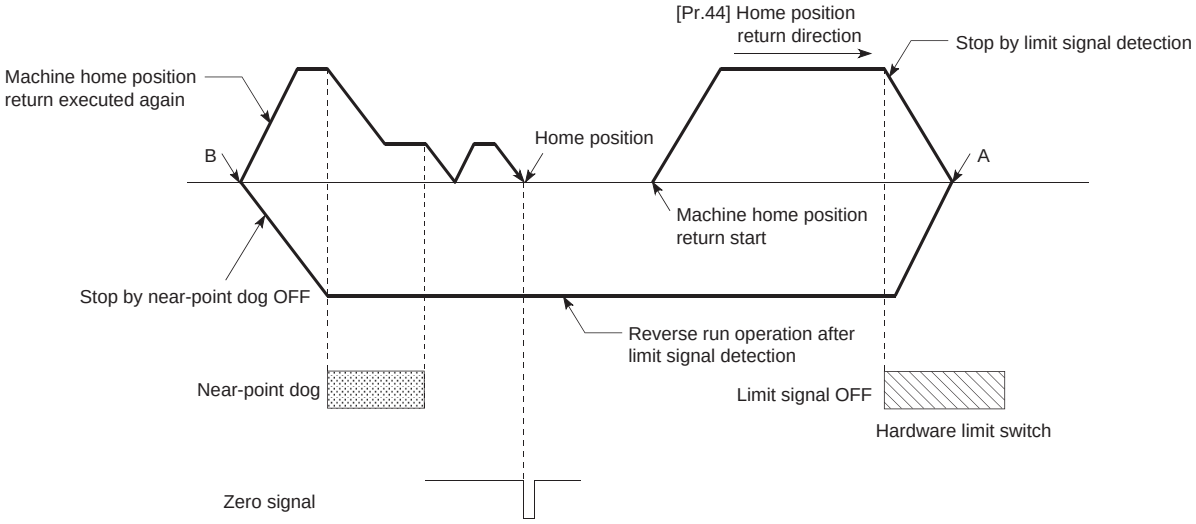



**Point**

- When the "0: Positive direction" is selected in "[Pr.44] Home position return direction", the upper limit switch is set to the limit switch in the home position return direction.
- When the "1: Negative direction" is selected in "[Pr.44] Home position return direction", the lower limit switch is set to the limit switch in the home position return direction.
- If inverting the install positions of upper/lower limit switches, hardware stroke limit function cannot be operated properly. If any problem is found for home position return operation, review "Rotation direction selection/travel direction selection (PA14)" and the wiring for the upper/lower limit switch.

### ■Setting the dwell time during a home position return retry

The home position return retry function can perform such function as the dwell time using "[Pr.57] Dwell time during home position return retry" when the reverse run operation is carried out due to detection by the limit signal for upper and lower limits and when the machine home position return is executed after the near point dog is turned OFF to stop the operation. "[Pr.57] Dwell time during home position return retry" is validated when the operation stops at the "A" and "B" positions in the following drawing. (The dwell time is the same value at both positions "A" and "B".)




## Precaution during control

- The following table shows whether the home position return retry function may be executed by the "[Pr.43] Home position return method".

| [Pr.43] Home position return method | Execution status of home position return retry function |
|---|---|
| Near-point dog method | ○: Execution possible |
| Count method 1 | ○: Execution possible |
| Count method 2 | ○: Execution possible |
| Data set method | — |
| Scale origin signal detection method | ×: Execution not possible |

- Always establish upper/lower limit switches at the upper/lower limit positions of the machine. If the home position return retry function is used without hardware stroke limit switches, the motor will continue rotation until a hardware stroke limit signal is detected.
- Do not configure a system so that the servo amplifier power turns OFF by the upper/lower limit switches. If the servo amplifier power is turned OFF, the home position return retry cannot be carried out.
- The operation decelerates upon detection of the hardware limit signal, and the movement starts in the opposite direction. In this case, however, the error "Hardware stroke limit (+)" (error code: 1904H, 1905H) or "Hardware stroke limit (-)" (error code: 1906H, 1907H) does not occur.

**Point**

The settings of the upper/lower stroke limit signal are shown below. The home position return retry function can be used with either setting. (☞ Page 243 Hardware stroke limit function)

- External input signal of Simple Motion module
- External input signal of servo amplifier
- External input signal via CPU (buffer memory of Simple Motion module)

## Setting method

To use the "home position return retry function", set the required details in the parameters shown in the following table, and write them to the Simple Motion module.

When the parameters are set, the home position return retry function will be added to the machine home position return control. The set details are validated at the rising edge (OFF → ON) of the PLC READY signal [Y0]. Set "[Pr.57] Dwell time during home position return retry" according to the user's requirements.

| Setting item | | Setting value | Setting details | Factory-set initial value |
|---|---|---|---|---|
| [Pr.48] | Home position return retry | 1 | Set "1: Carry out home position return retry by limit switch". | 0 |
| [Pr.57] | Dwell time during home position return retry | → | Set the deceleration stop time during home position return retry. (Random value between 0 and 65535 (ms)) | 0 |

Refer to the following for the setting details.

☞ Page 407 Basic Setting

**Point**

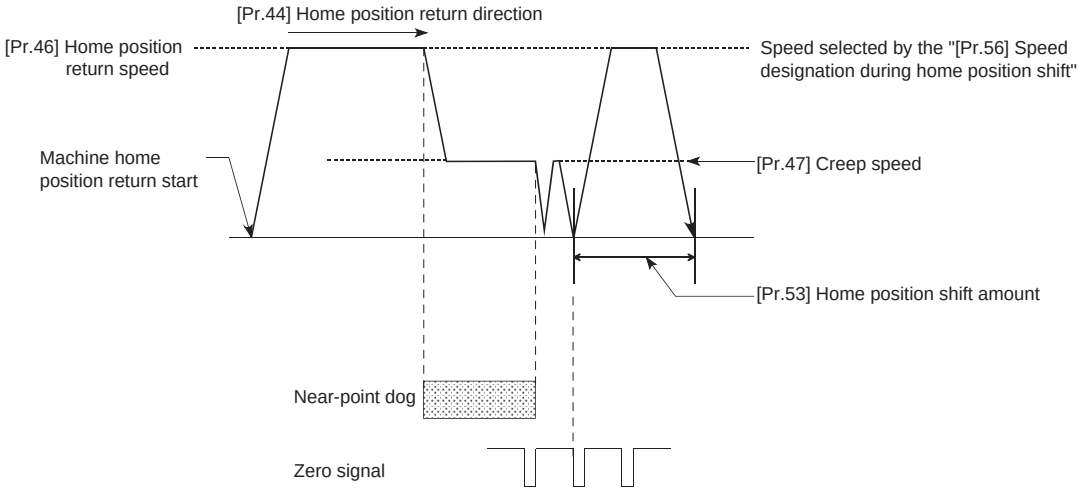
- Parameters are set for each axis.
- It is recommended that the parameters be set whenever possible with the engineering tool. Execution by a program uses many programs and devices. The execution becomes complicated, and the scan times will increase.

# Home position shift function

When a machine home position return is carried out, the home position is normally established using the near-point dog and zero signal. However, by using the home position shift function, the machine can be moved a designated movement amount from the position where the zero signal was detected. A mechanically established home position can then be interpreted at that point.

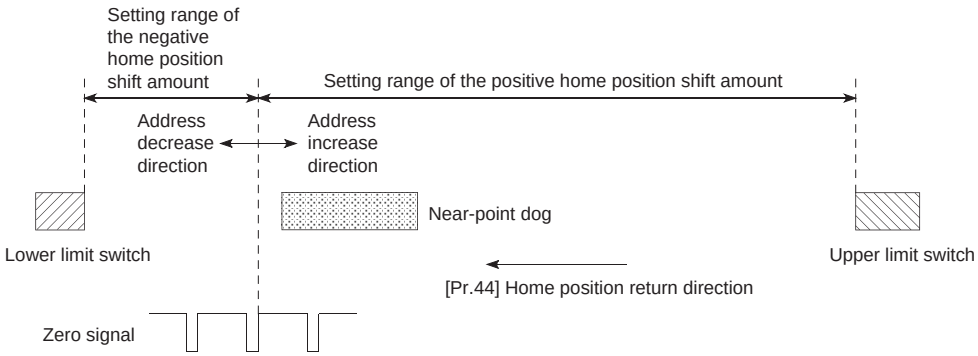
## Control details

The following drawing shows the operation of the home position shift function.


[Pr.44] Home position return direction
[Pr.46] Home position return speed
Speed selected by the "[Pr.56] Speed designation during home position shift"
Machine home position return start
[Pr.47] Creep speed
[Pr.53] Home position shift amount
Near-point dog
Zero signal

## Setting range for the home position shift amount

Set the home position shift amount within the range from the detected zero signal to the upper/lower limit switches.

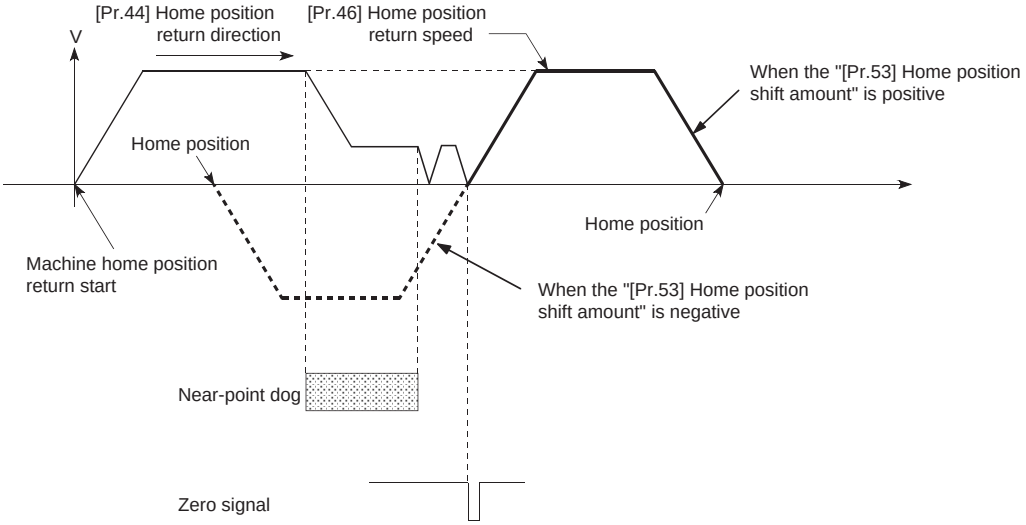

Setting range of the negative home position shift amount
Setting range of the positive home position shift amount
Address decrease direction
Address increase direction
Near-point dog
Lower limit switch
Upper limit switch
[Pr.44] Home position return direction
Zero signal

## Movement speed during home position shift

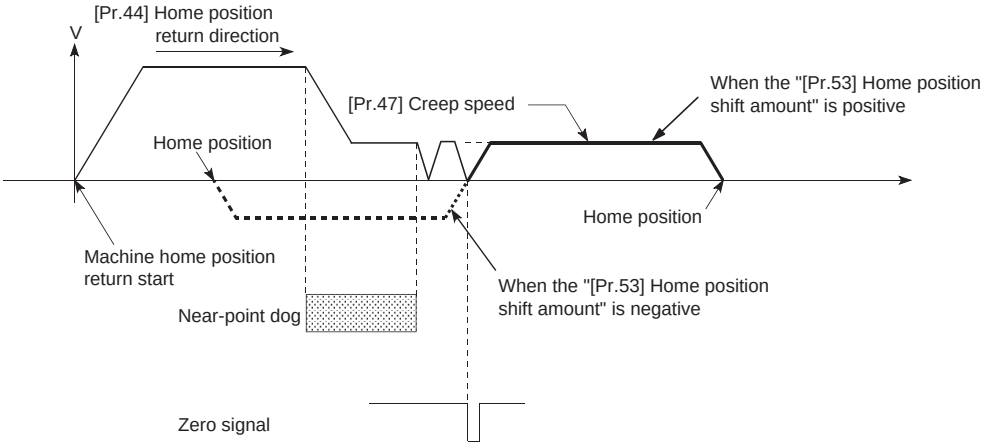
When using the home position shift function, the movement speed during the home position shift is set in "[Pr.56] Speed designation during home position shift". The movement speed during the home position shift is selected from either the "[Pr.46] Home position return speed" or the "[Pr.47] Creep speed". For the acceleration/deceleration time, the value specified in "[Pr.51] Home position return acceleration time selection" or "[Pr.52] Home position return deceleration time selection" is used.

The following drawings show the movement speed during the home position shift when a mechanical home position return is carried out by the near-point dog method.

### ■Home position shift operation at the "[Pr.46] Home position return speed" (When "[Pr.56] Speed designation during home position shift" is 0)


[Pr.44] Home position return direction
V
[Pr.46] Home position return speed
When the "[Pr.53] Home position shift amount" is positive
Home position
Home position
Machine home position return start
When the "[Pr.53] Home position shift amount" is negative
Near-point dog
Zero signal

### ■Home position shift operation at the "[Pr.47] Creep speed" (When "[Pr.56] Speed designation during home position shift" is 1)


[Pr.44] Home position return direction
V
[Pr.47] Creep speed
When the "[Pr.53] Home position shift amount" is positive
Home position
Home position
Machine home position return start
When the "[Pr.53] Home position shift amount" is negative
Near-point dog
Zero signal

## Precautions during control

• The following data are set after the home position shift amount is complete.

- Home position return complete flag ([Md.31] Status: b4)
- [Md.20] Current feed value
- [Md.21] Machine feed value
- [Md.26] Axis operation status

Home position return request flag ([Md.31] Status: b3) is reset after completion of the home position shift.

• "[Pr.53] Home position shift amount" is not added to "[Md.34] Movement amount after near-point dog ON". The movement amount immediately before the home position shift operation, considering near-point dog ON as "0", is stored.

## Setting method

To use the "home position shift function", set the required details in the parameters shown in the following table, and write them to the Simple Motion module.

When the parameters are set, the home position shift function will be added to the machine home position return control. The set details are validated at the rising edge (OFF → ON) of the PLC READY signal [Y0].

| Setting item | | Setting value | Setting details | Factory-set initial value |
|---|---|---|---|---|
| [Pr.53] | Home position shift amount | → | Set the shift amount during the home position shift. | 0 |
| [Pr.56] | Speed designation during home position shift | → | Select the speed during the home position shift<br>0: [Pr.46] Home position return speed<br>1: [Pr.47] Creep speed | 0 |

Refer to the following for the setting details.

☞ Page 407 Basic Setting

**Point**

• Parameters are set for each axis.

• It is recommended that the parameters be set whenever possible with the engineering tool. Execution by a program uses many programs and devices. The execution becomes complicated, and the scan times will increase.

# 8.3 Functions for Compensating the Control

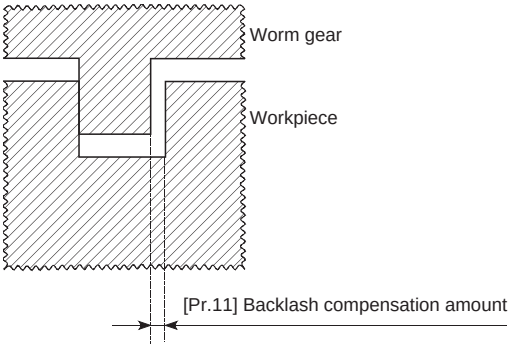
The sub functions for compensating the control include the "backlash compensation function", "electronic gear function", and "near pass function". Each function is executed by parameter setting or program creation and writing.

## Backlash compensation function

The "backlash compensation function" compensates the backlash amount in the mechanical system.
When the backlash compensation amount is set, an extra amount of command equivalent to the set backlash amount is output every time the movement direction changes.

### Control details

The following drawing shows the operation of the backlash compensation function.




### Precautions during control

- The feed command of the backlash compensation amount are not added to the "[Md.20] Current feed value" or "[Md.21] Machine feed value".
- Always carry out a machine home position return before starting the control when using the backlash compensation function (when "[Pr.11] Backlash compensation amount" is set). The backlash in the mechanical system cannot be correctly compensated if a machine home position return is not carried out.
- Backlash compensation, which includes the movement amount and "[Pr.11] Backlash compensation amount", is output the moment at the moving direction changes.
- Backlash compensation cannot be made when the speed control mode, torque control mode or continuous operation to torque control mode.

### Setting method

To use the "backlash compensation function", set the "backlash compensation amount" in the parameter shown in the following table, and write it to the Simple Motion module.
The set details are validated at the rising edge (OFF → ON) of the PLC READY signal [Y0].

| Setting item | | Setting value | Setting details | Factory-set initial value |
|---|---|---|---|---|
| [Pr.11] | Backlash compensation amount | → | Set the backlash compensation amount. | 0 |

Refer to the following for the setting details.
☞ Page 407 Basic Setting

**Point**

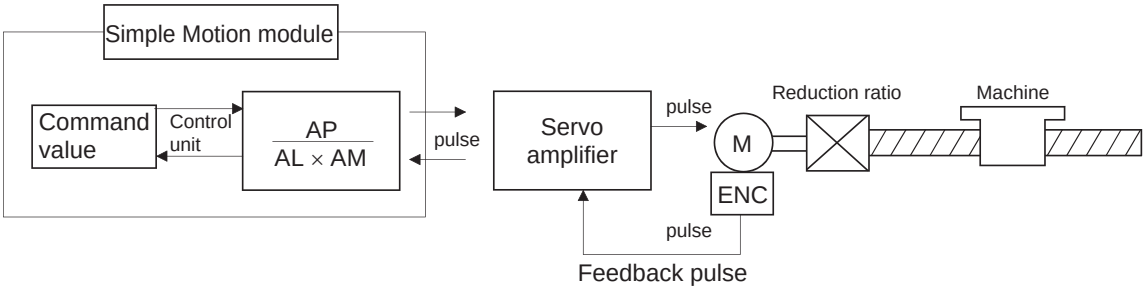
- Parameters are set for each axis.
- It is recommended that the parameters be set whenever possible with the engineering tool. Execution by a program uses many programs and devices. The execution becomes complicated, and the scan times will increase.

# Electronic gear function

The "electronic gear function" adjusts the actual machine movement amount and number of pulse output to servo amplifier according to the parameters set in the Simple Motion module.
The "electronic gear function" has the following three functions ( [A] to [C] ).
[A] During machine movement, the function increments in the Simple Motion module values less than one pulse that could not be output, and outputs the incremented amount when the total incremented value reached one pulse or more.
[B] When machine home position return is completed, current value changing is completed, speed control is started (except when current feed value change is present), or fixed-feed control is started, the function clears to "0" the cumulative values of less than one pulse which could not be output. (If the cumulative value is cleared, an error will occur by a cleared amount in the feed machine value. Control can be constantly carried out at the same machine movement amount, even when the fixed-feed control is continued.)
[C] The function compensates the mechanical system error of the command movement amount and actual movement amount by adjusting the "electronic gear". (The "movement amount per pulse" value is defined by "[Pr.2] Number of pulses per rotation (AP)", "[Pr.3] Movement amount per rotation (AL)" and "[Pr.4] Unit magnification (AM)".)
The Simple Motion module automatically carries out the processing for [A] and [B].

## Basic concept of the electronic gear

The electronic gear is an item which determines how many rotations (rotations by how many pulses) the motor must make in order to move the machine according to the programmed movement amount.



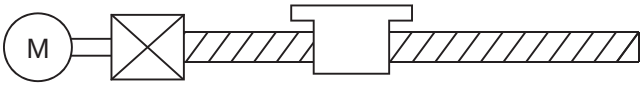

The basic concept of the electronic gear is represented by the following expression.
[Pr.2] (Number of pulses per rotation) = AP
[Pr.3] (Movement amount per rotation) = AL
[Pr.4] (Unit magnification) = AM
Movement amount per rotation that considered unit magnification = ΔS

$$\text{Electronic gear} = \frac{AP}{\Delta S} = \frac{AP}{AL \times AM} \cdots (1)$$

Set values for AP, AL and AM so that this related equation is established.
However, because values to be set for AP, AL and AM have the settable range, values calculated (reduced) from the above related equation must be contained in the setting range for AP, AL and AM.

## ■For "Ball screw" + "Reduction gear"

When the ball screw pitch is 10 mm, the motor is the HG-KR (4194304 pulses/rev) and the reduction ratio of the reduction gear is 9/44.




Reduction ratio 9/44

First, find how many millimeters the load (machine) will travel (ΔS) when the motor turns one revolution (AP).

AP (Number of pulses per rotation) = 4194304 [pulse]

ΔS (Movement amount per rotation) = Ball screw pitch × Reduction ratio

= 10 [mm] × 9/44

= 10000.0 [μm] × 9/44

When the control unit is "mm", the minimum command unit is 0.1 m.

Substitute this for the above expression (1).

At this time, make calculation with the reduction ratio 9/44 remaining as a fraction.

$$\frac{AP}{\Delta S} = \frac{4194304\ [pulse]}{10000.0\ [\mu m] \times 9/44}$$

$$= \frac{4194304 \times 44}{10000.0 \times 9}$$

$$= \frac{184549376}{90000.0}$$

$$= \frac{23068672}{11250.0} = \frac{23068672(AP)}{11250.0(AL) \times 1(AM)}$$

$$= \frac{23068672(AP)}{1125.0(AL) \times 10(AM)}$$

Thus, AP, AL and AM to be set are as follows.

| Setting value | Setting item |
|---|---|
| AP = 23068672 | [Pr.2] |
| AL = 11250.0 | [Pr.3] |
| AM = 1 | [Pr.4] |

or

| Setting value | Setting item |
|---|---|
| AP = 23068672 | [Pr.2] |
| AL = 1125.0 | [Pr.3] |
| AM = 10 | [Pr.4] |

*1 These two examples of settings are only examples. There are settings other than these examples.

## ■When "pulse" is set as the control unit

When using pulse as the control unit, set the electronic gear as follows.

AP = "Number of pulses per rotation"

AL = "Movement amount per rotation"

AM = 1

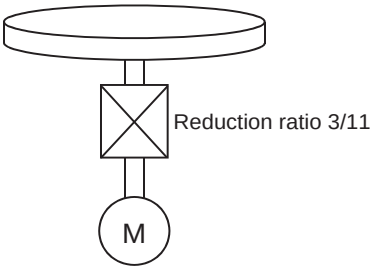
**Ex.**

When the motor is the HG-KR (4194304 pulses/rev)

| Setting value | Setting item |
|---|---|
| AP = 4194304 | [Pr.2] |
| AL = 4194304 | [Pr.3] |
| AM = 1 | [Pr.4] |

## ■When "degree" is set as the control unit for a rotary axis

When the rotary axis is used, the motor is HG-KR (4194304 pulses/rev) and the reduction ratio of the reduction gear is 3/11.




First, find how many degrees the load (machine) will travel (ΔS) when the motor turns one revolution (AP).

AP (Number of pulses per rotation) = 4194304 [pulse]

ΔS (Movement amount per rotation)

= 360.00000 [degree] × Reduction ratio

= 360.00000 × 3/11

Substitute this for the above expression (1).

At this time, make calculation with the reduction ratio 3/11 remaining as a fraction.

$$\frac{AP}{\Delta S} = \frac{4194304\ [pulse]}{360.00000\ [degree] \times 3/11}$$

$$= \frac{4194304\ [pulse] \times 11}{360.00000\ [degree] \times 3}$$

$$= \frac{46137344}{1080.00000}$$

$$= \frac{2883584}{67.50000} = \frac{2883584(AP)}{67.50000(AL) \times 1(AM)}$$

$$= \frac{2883584(AP)}{0.06750(AL) \times 1000(AM)}$$

Thus, AP, AL and AM to be set are as follows.

| Setting value | Setting item |
|---|---|
| AP = 2883584 | [Pr.2] |
| AL = 67.50000 | [Pr.3] |
| AM = 1 | [Pr.4] |

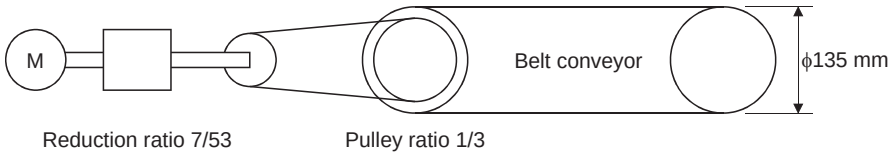
or

| Setting value | Setting item |
|---|---|
| AP = 2883584 | [Pr.2] |
| AL = 0.06750 | [Pr.3] |
| AM = 1000 | [Pr.4] |

*1 These two examples of settings are only examples. There are settings other than these examples.

## ■When "mm" is set as the control unit for conveyor drive (calculation including π)

When the belt conveyor drive is used, the conveyor diameter is 135 mm, the pulley ratio is 1/3, the motor is HG-KR (4194304 pulses/rev) and the reduction ratio of the reduction gear is 7/53.




As the travel value of the conveyor is used to exercise control, set "mm" as the control unit.

First, find how many millimeters the load (machine) will travel (ΔS) when the motor turns one revolution (AP).

AP (Number of pulses per rotation) = 4194304 [pulse]

ΔS (Movement amount per rotation)

= 135000.0 [μm] × π × Reduction ratio

= 135000.0 [μm] × π × 7/53 × 1/3

Substitute this for the above expression (1).

At this time, make calculation with the reduction ratio 7/53 × 1/3 remaining as a fraction.

$$\frac{AP}{\Delta S} = \frac{AP}{AL \times AM} = \frac{4194304\ [pulse]}{135000.0\ [\mu m] \times \pi \times 7/53 \times 1/3}$$

$$= \frac{4194304 \times 53 \times 3}{135000.0 \times \pi \times 7}$$

$$= \frac{166723584}{236250 \times \pi}$$

Here, make calculation on the assumption that π is equal to 3.141592654.

$$\frac{AP}{\Delta S} = \frac{AP}{AL \times AM} = \frac{166723584}{742201.2645075}$$

AL has a significant number to first decimal place, round down numbers to two decimal places.

$$\frac{AP}{\Delta S} = \frac{AP}{AL \times AM} = \frac{166723584}{742201.2} = \frac{166723584(AP)}{742201.2(AL) \times 1(AM)}$$

Thus, AP, AL and AM to be set are as follows.

| Setting value | Setting item |
|---|---|
| AP = 166723584 | [Pr.2] |
| AL = 742201.2 | [Pr.3] |
| AM = 1 | [Pr.4] |

This setting will produce an error for the true machine value, but it cannot be helped.

This error is as follows.

$$\left( \frac{7422012/166723584}{2362500\pi/166723584} - 1 \right) \times 100 = -8.69 \times 10^{-6}\ [\%]$$

AP (Number of pulses per rotation) = 4194304 [pulse]

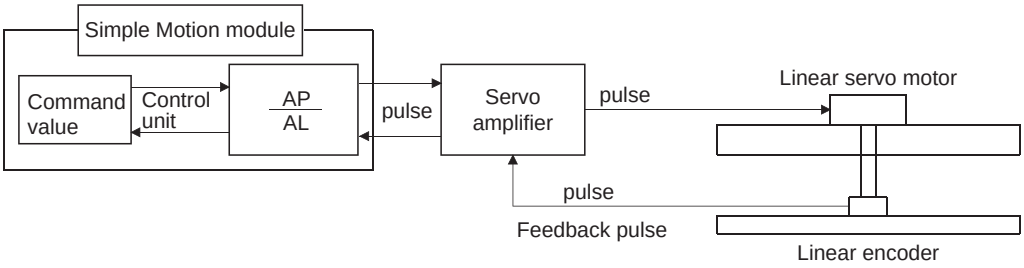
ΔS (Movement amount per rotation)

= 135000.0 [μm] × π × Reduction ratio

= 135000.0 [μm] × π × 7/53 × 1/3

It is equivalent to an about 86.9 [μm] error in continuous 1 km feed.

## ■Number of pulses/ movement amount at linear servo use




Calculate the number of pulses (AP) and movement amount (AL) for the linear encoder in the following conditions.

$$\text{Linear encoder resolution} = \frac{\text{Number of pulses (AP)}}{\text{Movement amount (AL)}}$$

Linear encoder resolution: 0.05 [μm]

$$\frac{\text{Number of pulses (AP) [pulse]}}{\text{Movement amount (AL) [μm]}} = \frac{1}{0.05} = \frac{20}{1.0}$$

Set the number of pulses in "[Pr.2] Number of pulses per rotation (AP)", and the movement amount in "[Pr.3] Movement amount per rotation (AL)" in the actual setting.

*1 Set the same value as the value set in the fixed parameter to the servo parameter "Linear encoder resolution setting Numerator (PS02)" and "Linear encoder resolution setting Denominator (PS03)". Refer to each servo amplifier instruction manual for details.

## The method for compensating the error

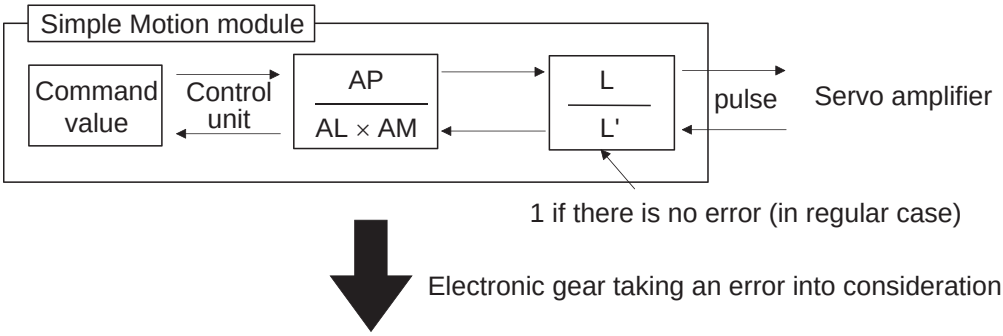
When the position control is carried out using the "Electronic gear" set in a parameter, this may produce an error between the command movement amount (L) and the actual movement amount (L'). With Simple Motion module, this error is compensated by adjusting the electronic gear.

The "Error compensation amount", which is used for error compensation, is defined as follows:

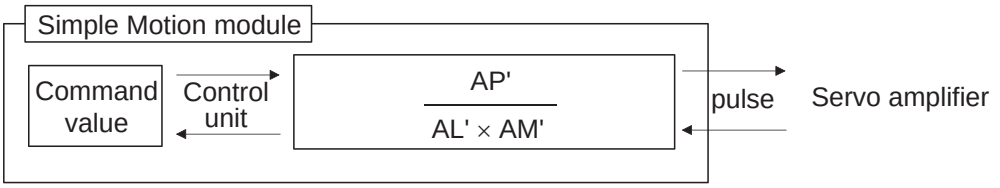
$$\text{Error compensation amount} = \frac{\text{Command movement amount (L)}}{\text{Actual movement amount (L')}} \quad \cdots (2)$$

The electronic gear including an error compensation amount is shown below.

$$\frac{AP}{AL \times AM} \times \frac{L}{L'} = \frac{AP'}{AL' \times AM'}$$




Electronic gear taking an error into consideration




### ■Calculation example

(Conditions)

Number of pulses per rotation (AP) : 4194304 [pulse]
Movement amount per rotation (AL) : 5000.0 [μm]
Unit magnification (AM) : 1

(Positioning results)

Command movement amount (L) : 100 [mm]
Actual movement amount (L') : 101 [mm]

(Compensation value)

$$\frac{AP}{AL \times AM} \times \frac{L}{L'} = \frac{4194304}{5000.0 \times 1} \times \frac{100}{101} = \frac{4194304(AP')}{5050(AL') \times 1(AM')}$$

Number of pulses per rotation (AP') : 4194304 ・・・[Pr.2]
Movement amount per rotation (AL') : 5050.0 ・・・[Pr.3]
Unit magnification (AM') : 1 ・・・・・・[Pr.4]

Set the post-compensation "[Pr.2] Number of pulses per rotation (AP')", "[Pr.3] Movement amount per rotation (AL')", and "[Pr.4] Unit magnification (AM')" in the parameters, and write them to the Simple Motion module. The set details are validated at the rising edge (OFF → ON) of the PLC READY signal [Y0].

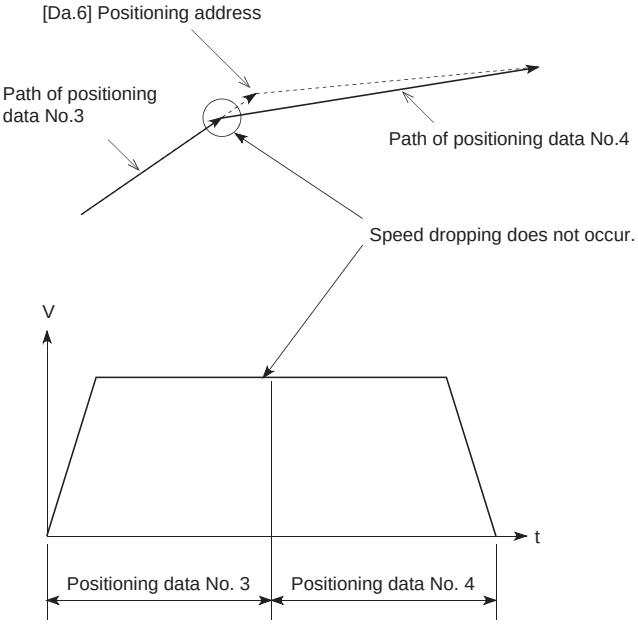
# Near pass function

When continuous pass control is carried out using interpolation control, the near pass function is carried out.
The "near pass function" is a function to suppress the mechanical vibration occurring at the time of switching the positioning data when continuous pass control is carried out using interpolation control.
[Near pass function]
The extra movement amount occurring at the end of each positioning data unit being continuously executed is carried over to the next positioning data unit. Alignment is not carried out, and thus the output speed drops are eliminated, and the mechanical vibration occurring during speed changes can be suppressed.
Because alignment is not carried out, the operation is controlled on a path that passes near the position set in "[Da.6] Positioning address/movement amount".

## Control details

The following drawing shows the path of the continuous path control by the 2-axis linear interpolation control.

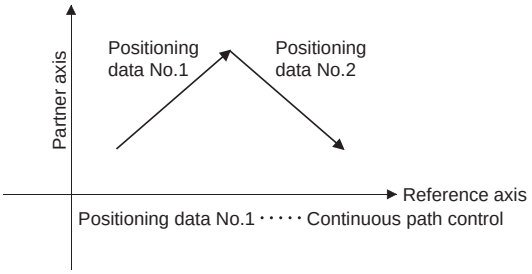
### ■The path of the near pass



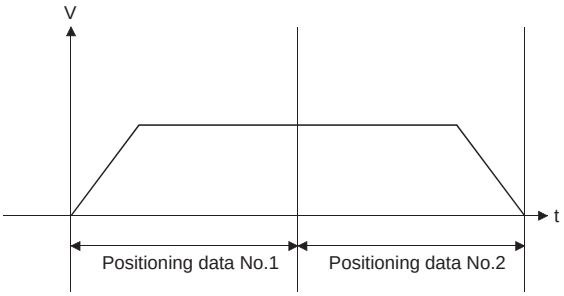
## Precautions during control

- If the movement amount designated by the positioning data is small when the continuous path control is executed, the output speed may not reach the designated speed.
- The movement direction is not checked during interpolation operation. Therefore, a deceleration stops are not carried out even if the movement direction changes. (See below) For this reason, the output will suddenly reverse when the reference axis movement direction changes. To prevent the sudden output reversal, assign not the continuous path control "11", but the continuous positioning control "01" to the positioning data of the passing point.

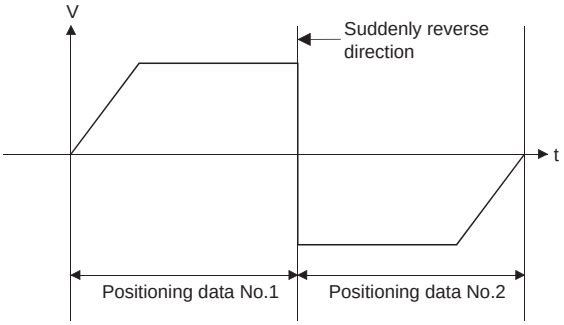
### ■Positioning by interpolation




### ■Operation of reference axis




### ■Operation of partner axis for interpolation



# 8.4 Functions to Limit the Control

Functions to limit the control include the "speed limit function", "torque limit function", "software stroke limit function", "hardware stroke limit function", and "forced stop function". Each function is executed by parameter setting or program creation and writing.

## Speed limit function

The speed limit function limits the command speed to a value within the "speed limit value" setting range when the command speed during control exceeds the "speed limit value".

### Relation between the speed limit function and various controls

The following table shows the relation of the "speed limit function" and various controls.

◎: Always set

—: Setting not required (The setting value is invalid. Use the initial value or a value within the setting range.)

| Control type | | | Speed limit function | Speed limit value |
|---|---|---|---|---|
| Home position return control | Machine home position return control | | ◎ | [Pr.8] Speed limit value |
| | Fast home position return control | | ◎ | |
| Major positioning control | Position control | 1-axis linear control | ◎ | |
| | | 2 to 4-axis linear interpolation control | ◎ | |
| | | 1-axis fixed-feed control | ◎ | |
| | | 2 to 4-axis fixed-feed control (interpolation) | ◎ | |
| | | 2-axis circular interpolation control | ◎ | |
| | | 3-axis helical interpolation control | ◎ | |
| | 1 to 4-axis speed control | | ◎ | |
| | Speed-position switching control, Position-speed switching control | | ◎ | |
| | Other control | Current value changing | — | Setting value invalid |
| | | JUMP instruction, NOP instruction, LOOP to LEND | — | |
| Manual control | JOG operation, Inching operation | | ◎ | [Pr.31] JOG speed limit value |
| | Manual pulse generator operation | | — | Setting is invalid |
| Expansion control | Speed-torque control | | ◎ | [Pr.8] Speed limit value |

### Precautions during control

- If any axis exceeds "[Pr.8] Speed limit value" during 2- to 4-axis speed control, the axis exceeding the speed limit value is controlled with the speed limit value. The speeds of the other axes being interpolated are suppressed by the command speed ratio.
- If the reference axis exceeds "[Pr.8] Speed limit value" during 2-axis circular interpolation control, the reference axis is controlled with the speed limit value (The speed limit does not function on the interpolation axis side.)
- If any axis exceeds "[Pr.8] Speed limit value" during 2- to 4-axis linear interpolation control or 2- to 4-axis fixed-feed control, the axis exceeding the speed limit value is controlled with the speed limit value. The speeds of the other axes being interpolated are suppressed by the movement amount ratio.
- In the 3-axis helical interpolation control, the composite speed of the circular interpolation axis or the speed of the linear interpolation axis is controlled not to exceed "[Pr.8] Speed limit value". (However, when the movement amount of the linear interpolation axis is more than the composite movement amount of the circular interpolation axis, such as when the number of pitches ("[Da.10] M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches") set in the linear interpolation axis is less, the speed of the linear interpolation axis cannot be suppressed with "[Pr.8] Speed limit value".)

**Point**

When the "reference axis speed" is set during interpolation control, set so the major axis side becomes the reference axis. If the minor axis side is set as the reference axis, the major axis side speed may exceed the "[Pr.8] Speed limit value".

## Setting method

To use the "speed limit function", set the "speed limit value" in the parameters shown in the following table, and write them to the Simple Motion module.

The set details are validated at the next start after they are written to the Simple Motion module.

| Setting item | | Setting value | Setting details | Factory-set initial value |
|---|---|---|---|---|
| [Pr.8] | Speed limit value | → | Set the speed limit value (max. speed during control). | 200000 |
| [Pr.31] | JOG speed limit value | → | Set the speed limit value during JOG operation (max. speed during control). (Note that "[Pr.31] JOG speed limit value" shall be less than or equal to "[Pr.8] Speed limit value".) | 20000 |

Refer to the following for the setting details.

☞ Page 407 Basic Setting

**Point**

- Parameters are set for each axis.
- It is recommended that the parameters be set whenever possible with the engineering tool. Execution by a program uses many programs and devices. The execution becomes complicated, and the scan times will increase.

# Torque limit function

The "torque limit function" limits the generated torque to a value within the "torque limit value" setting range when the torque generated in the servomotor exceeds the "torque limit value".
The "torque limit function" protects the deceleration function, limits the power of the operation pressing against the stopper, etc. It controls the operation so that unnecessary force is not applied to the load and machine.

## Relation between the torque limit function and various controls

The following table shows the relation of the "torque limit function" and various controls.
○: Set when required (Set to " — " when not used.)
—: Setting not required (The setting value is invalid. Use the initial value or a value within the setting range.)

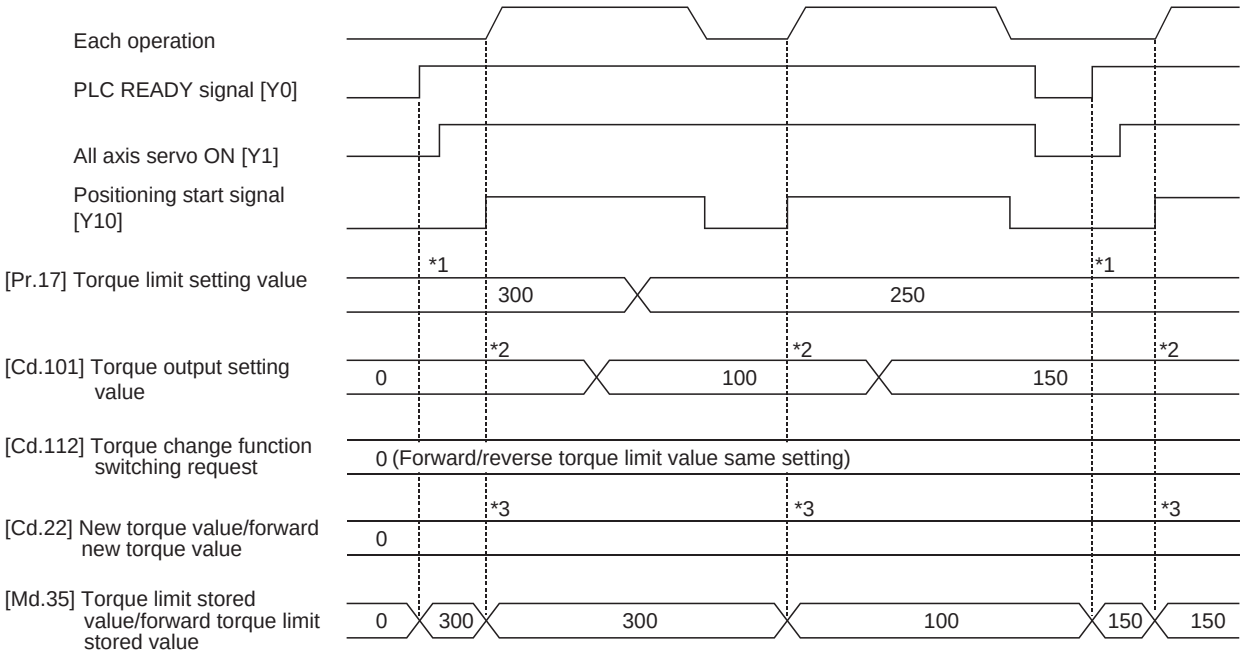
| Control type | | | Torque limit function | Torque limit value *1 |
|---|---|---|---|---|
| Home position return control | Machine home position return control | | ○ | "[Pr.17] Torque limit setting value" or "[Cd.101] Torque output setting value". After the "[Pr.47] Creep speed" is reached, this value becomes the "[Pr.54] Home position return torque limit value". |
| | Fast home position return control | | ○ | "[Pr.17] Torque limit setting value" or "[Cd.101] Torque output setting value". |
| Major positioning control | Position control | 1-axis linear control | ○ | |
| | | 2 to 4-axis linear interpolation control | ○ | |
| | | 1-axis fixed-feed control | ○ | |
| | | 2 to 4-axis fixed-feed control (interpolation) | ○ | |
| | | 2-axis circular interpolation control | ○ | |
| | | 3-axis helical interpolation control | ○ | |
| | 1 to 4-axis speed control | | ○ | |
| | Speed-position switching control, Position-speed switching control | | ○ | |
| | Other control | Current value changing | — | Setting value is invalid. |
| | | JUMP instruction, NOP instruction, LOOP to LEND | — | |
| Manual control | JOG operation, Inching operation | | ○ | "[Pr.17] Torque limit setting value" or "[Cd.101] Torque output setting value". |
| | Manual pulse generator operation | | ○ | |
| Expansion control | Speed-torque control | | ○ | Torque limit value is continued after control mode switching. |

*1 Shows the torque limit value when "[Cd.22] New torque value/forward new torque value" or "[Cd.113] Reverse new torque value" is set to "0".

## Control details

The following drawing shows the operation of the torque limit function.

### ■RD77MS4 operation example




*1 The torque limit setting value or torque output setting value becomes effective at the PLC READY signal [Y0] rising edge (however, after the servo turned ON.)
If the torque output setting value is "0" or larger than the torque limit setting value, the torque limit setting value will be its value.

*2 The torque limit setting value or torque output setting value becomes effective at the positioning start signal [Y10] rising edge.
If the torque output setting value is "0" or larger than the torque limit setting value, the torque limit setting value will be its value.

*3 The torque change value is cleared to "0" at the positioning start signal [Y10] rising edge.

## Precautions during control

- When limiting the torque at the "[Pr.17] Torque limit setting value", confirm that "[Cd.22] New torque value/forward new torque value" or "[Cd.113] Reverse new torque value" is set to "0". If this parameter is set to a value besides "0", the setting value will be validated, and the torque will be limited at that value. (Refer to ☞ Page 259 Torque change function for details about the "new torque value".)
- When the "[Pr.54] Home position return torque limit value" exceeds the "[Pr.17] Torque limit setting value", the error "Home position return torque limit value error" (error code: 1B0DH, 1B0EH) occurs.
- When the operation is stopped by torque limiting, the droop pulse will remain in the deviation counter. If the load torque is eliminated, operation for the amount of droop pulses will be carried out. Note that the movement might start suddenly as soon as the load torque is eliminated.

## Setting method

- To use the "torque limit function", set the "torque limit value" in the parameters shown in the following table, and write them to the Simple Motion module. The set details are validated at the rising edge (OFF → ON) of the PLC READY signal [Y0].

| Setting item | | Setting value | Setting details | Factory-set initial value |
|---|---|---|---|---|
| [Pr.17] | Torque limit setting value | → | Set the torque limit value in 0.1% unit. | 3000 |
| [Pr.54] | Home position return torque limit value | → | Set the torque limit value after the speed reaches "[Pr.47] Creep speed" in 0.1% unit. | 3000 |

- The set details are validated at the rising edge (OFF → ON) of the positioning start signal [Y10].

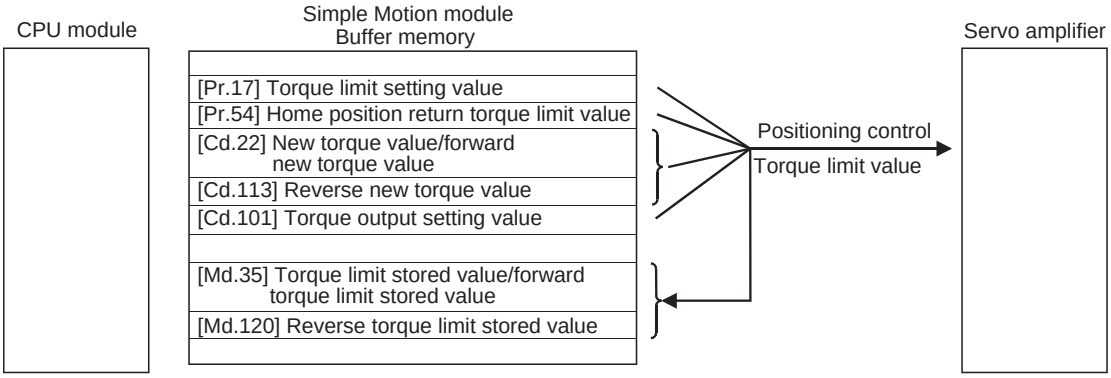
| Setting item | | Setting value | Setting details | Factory-set initial value |
|---|---|---|---|---|
| [Cd.101] | Torque output setting value | → | Set the torque output value in 0.1% unit. | 0 |

*1 Refer to the followings for the setting details.
☞ Page 407 Basic Setting, Page 504 Control Data

*2 Torque limit value: Will be an upper limit value of the torque change value. If a larger value has been mistakenly input for the torque change value, it is restricted within the torque limit setting values to prevent an erroneous entry. (Even if a value larger than the torque limit setting value has been input to the torque change value, the torque value is not changed.)

*3 Torque output setting value: Taken at the positioning start and used as a torque limit value. If the value is "0" or the torque limit setting value or larger, the parameter "torque limit setting value" is taken at the start.

- The "torque limit value" set in the Simple Motion module is set in the "[Md.35] Torque limit stored value/forward torque limit stored value" or "[Md.120] Reverse torque limit stored value".


CPU module
Simple Motion module
Buffer memory
[Pr.17] Torque limit setting value
[Pr.54] Home position return torque limit value
[Cd.22] New torque value/forward new torque value
[Cd.113] Reverse new torque value
[Cd.101] Torque output setting value
[Md.35] Torque limit stored value/forward torque limit stored value
[Md.120] Reverse torque limit stored value
Positioning control
Torque limit value
Servo amplifier

- The following table shows the storage details of "[Md.35] Torque limit stored value/forward torque limit stored value" and "[Md.120] Reverse torque limit stored value".

n: Axis No. - 1

| Monitor item | | Monitor value | Storage details | Buffer memory address |
|---|---|---|---|---|
| [Md.35] | Torque limit stored value/forward torque limit stored value | → | The "torque limit value/forward torque limit stored value" valid at that time is stored. ([Pr.17], [Pr.54], [Cd.22] or [Cd.101]) | 2426+100n |
| [Md.120] | Reverse torque limit stored value | → | The "reverse torque limit stored value" is stored depending on the control status. ([Pr.17], [Pr.54], [Cd.22], [Cd.101] or [Cd.113]) | 2491+100n |

Refer to the following for information on the storage details.
☞ Page 468 Monitor Data

**Point**

- Parameters are set for each axis.
- It is recommended that the parameters be set whenever possible with the engineering tool. Execution by a program uses many programs and devices. The execution becomes complicated, and the scan times will increase.
- Use "[Md.120] Reverse torque limit stored value" and "[Cd.113] Reverse new torque value" only when "1: Forward/reverse torque limit value individual setting" is set in "[Cd.112] Torque change function switching request". (☞ Page 259 Torque change function)

# Software stroke limit function

In the "software stroke limit function" the address established by a machine home position return is used to set the upper and lower limits of the moveable range of the workpiece. Movement commands issued to addresses outside that setting range will not be executed.

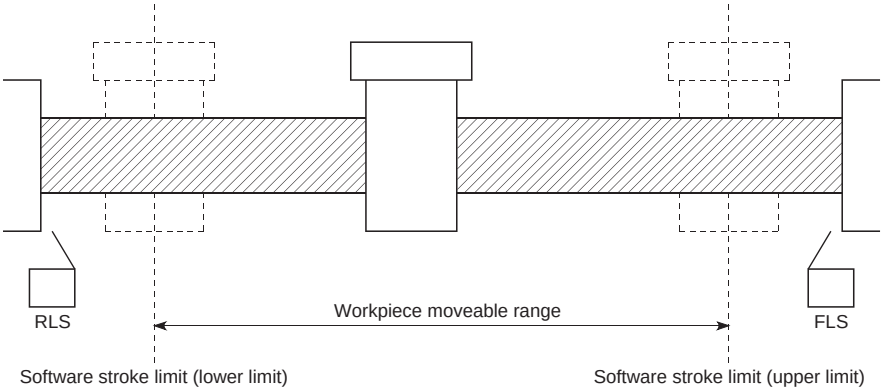
In the Simple Motion module, the "current feed value" and "machine feed value" are used as the addresses indicating the current position. However, in the "software stroke limit function", the address used to carry out the limit check is designated in the "[Pr.14] Software stroke limit selection". Refer to the following for details on the "current feed value" and "machine feed value".

☞ Page 59 Confirming the current value

The upper and lower limits of the moveable range of the workpiece are set in "[Pr.12] Software stroke limit upper limit value"/ "[Pr.13] Software stroke limit lower limit value".

## Differences in the moveable range

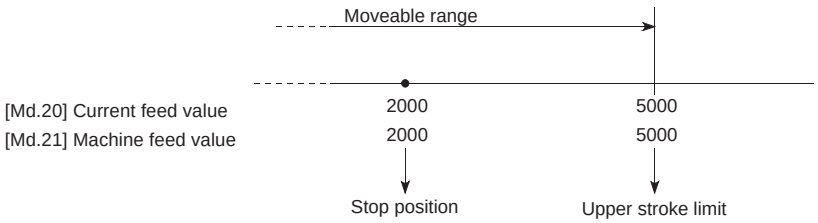
The following drawing shows the moveable range of the workpiece when the software stroke limit function is used.




The following drawing shows the differences in the operation when "[Md.20] Current feed value" and "[Md.21] Machine feed value" are used in the moveable range limit check.

### ■Conditions

Assume the current stop position is 2000, and the upper stroke limit is set to 5000.

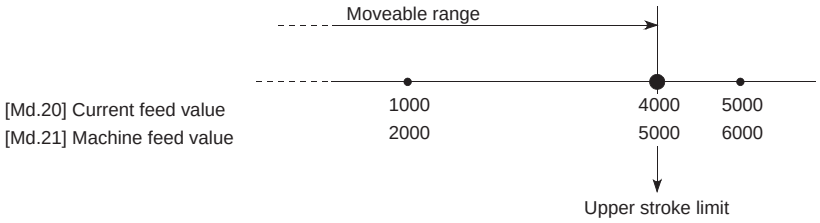


## ■Current value changing

When the current value is changed by a new current value command from 2000 to 1000, the current value will change to 1000, but the machine feed value will stay the same at 2000.

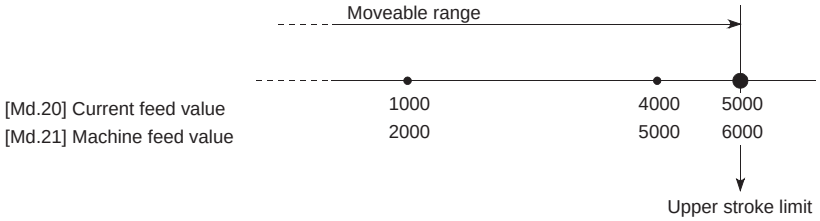
- When the machine feed value is set at the limit

The machine feed value of 5000 (current feed value: 4000) becomes the upper stroke limit.




- When the current feed value is set at the limit

The current feed value of 5000 (machine feed value: 6000) becomes the upper stroke limit.




**Point**

When "machine feed value" is set in "[Pr.14] Software stroke limit selection", the moveable range becomes an absolute range referenced on the home position. When "current feed value" is set, the moveable range is the relative range from the "current feed value".

## Software stroke limit check details

| Check details | | Processing when an error occurs |
|---|---|---|
| 1) | An error shall occur if the current value*1 is outside the software stroke limit range*2. (Check "[Md.20] Current feed value" or "[Md.21] Machine feed value".) | An "axis error" will occur (error code: 1993H, 1995H, 1A18H, 1A1AH) |
| 2) | An error shall occur if the command address is outside the software stroke limit range. (Check "[Da.6] Positioning address/ movement amount".) | |

*1 Check whether the "[Md.20] Current feed value" or "[Md.21] Machine feed value" is set in "[Pr.14] Software stroke limit selection".

*2 Moveable range from the "[Pr.12] Software stroke limit upper limit value" to the "[Pr.13] Software stroke limit lower limit value".

## Relation between the software stroke limit function and various controls

◎: Check valid

○: Check is not made when the current feed value is not updated (☞ Page 422 [Pr.21] Current feed value during speed control) at the setting of "current feed value" in "[Pr.14] Software stroke limit selection" during speed control.

—: Check not carried out (check invalid).

△: Valid only when "0: valid" is set in the "[Pr.15] Software stroke limit valid/invalid setting".

| Control type | | | Limit check | Processing at check |
|---|---|---|---|---|
| Home position return control | Machine home position return control | Data set method | ◎ | The current value will not be changed if the home position address is outside the software stroke limit range. |
| | | Other than "Data set method" | — | Check not carried out. |
| | Fast home position return control | | — | |
| Major positioning control | Position control | 1-axis linear control | ◎ | Checks 1) and 2) in ☞ Page 239 Software stroke limit check details are carried out.<br>For speed control: The axis decelerates to a stop when it exceeds the software stroke limit range.<br>For position control: The axis comes to an immediate stop when it exceeds the software stroke limit range. |
| | | 2 to 4-axis axis linear interpolation control | ◎ | |
| | | 1-axis fixed-feed control | ◎ | |
| | | 2 to 4-axis fixed-feed control (interpolation) | ◎ | |
| | | 2-axis circular interpolation control | ◎ | |
| | | 3-axis helical interpolation control | ◎ | |
| | 1 to 4-axis speed control | | ○*1*2 | |
| | Speed-position switching control, Position-speed switching control | | ○*1*2 | |
| | Other control | Current value changing | ◎ | The current value will not be changed if the new current value is outside the software stroke limit range. |
| | | JUMP instruction, NOP instruction, LOOP to LEND | — | Check not carried out. |
| Manual control | JOG operation, Inching operation | | △*3 | Check 1) in ☞ Page 239 Software stroke limit check details is carried out.<br>The machine will carry out a deceleration stop when the software stroke limit range is exceeded. If the address is outside the software stroke limit range, the operation can only be started toward the moveable range. |
| | Manual pulse generator operation | | △*3 | |
| Expansion control | Speed-torque control | | ◎ | Check 1) in ☞ Page 239 Software stroke limit check details is carried out.<br>The mode switches to the position control mode when the software stroke limit range is exceeded, and the operation immediately stops. |

*1 The value in "[Md.20] Current feed value" will differ according to the "[Pr.21] Current feed value during speed control" setting.

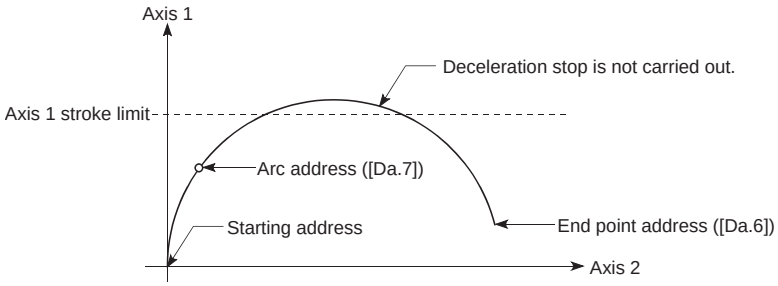
*2 When the unit is "degree", check is not made during speed control.

*3 When the unit is "degree", check is not carried out.

## Precautions during software stroke limit check

- A machine home position return must be executed beforehand for the "software stroke limit function" to function properly.
- During interpolation control, a stroke limit check is carried out for the every current value of both the reference axis and the interpolation axis. Every axis will not start if an error occurs, even if it only occurs in one axis.
- During circular interpolation control and 3-axis helical interpolation control (reference axis and interpolation axis), the "[Pr.12] Software stroke limit upper limit value"/"[Pr.13] Software stroke limit lower limit value" may be exceeded. In this case, a deceleration stop will not be carried out even if the stroke limit is exceeded. Always install an external limit switch if there is a possibility the stroke limit will be exceeded.

Ex.

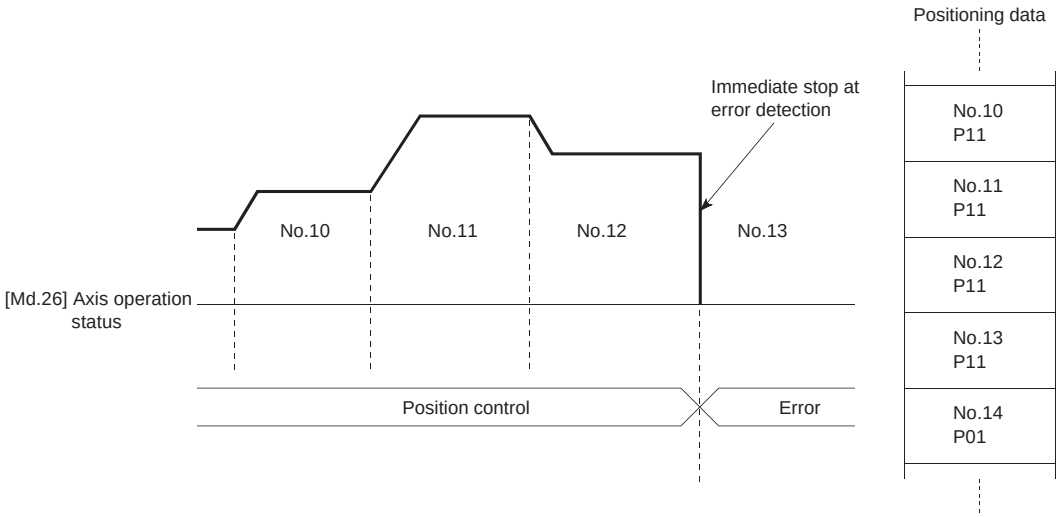



*1 The software stroke limit check is carried out for the following addresses during circular interpolation control.
(Note that "[Da.7] Arc address" is carried out only for circular interpolation control with sub point designation.)
Current value/end point address ([Da.6])/arc address ([Da.7])

- If an error is detected during continuous path control, the axis stops immediately on completion of execution of the positioning data located right before the positioning data in error.

Ex.

If the positioning address of positioning data No. 13 is outside the software stroke limit range, the operation immediately stops after positioning data No. 12 has been executed.




- During simultaneous start, a stroke limit check is carried out for the current values of every axis to be started. Every axis will not start if an error occurs, even if it only occurs in one axis.

## Setting method

To use the "software stroke limit function", set the required values in the parameters shown in the following table, and write them to the Simple Motion module.

The set details are validated at the rising edge (OFF → ON) of the PLC READY signal [Y0].

| Setting item | | Setting value | Setting details | Factory-set initial value |
|---|---|---|---|---|
| [Pr.12] | Software stroke limit upper limit value | → | Set the upper limit value of the moveable range. | 2147483647 |
| [Pr.13] | Software stroke limit lower limit value | → | Set the lower limit value of the moveable range. | -2147483648 |
| [Pr.14] | Software stroke limit selection | → | Set whether to use the "[Md.20] Current feed value" or "[Md.21] Machine feed value" as the "current value". | 0: Current feed value |
| [Pr.15] | Software stroke limit valid/invalid setting | 0: Valid | Set whether the software stroke limit is validated or invalidated during manual control (JOG operation, Inching operation, manual pulse generator operation). | 0: valid |

Refer to the following for the setting details.

☞ Page 407 Basic Setting

## Invalidating the software stroke limit

To invalidate the software stroke limit, set the following parameters as shown, and write them to the Simple Motion module. (Set the value within the setting range.)

(To invalidate only the manual operation, set "1: software stroke limit invalid" in the "[Pr.15] Software stroke limit valid/invalid setting".)

The set details are validated at the rising edge (OFF → ON) of the PLC READY signal [Y0].

When the unit is "degree", the software stroke limit check is not performed during speed control (including speed control in speed-position switching control or position-speed switching control) or during manual control, independently of the values set in [Pr.12], [Pr.13] and [Pr.15].

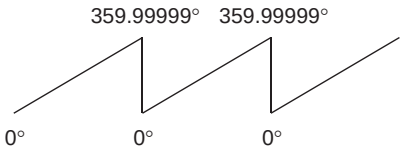
**Point**

- Parameters are set for each axis.
- It is recommended that the parameters be set whenever possible with the engineering tool. Execution by a program uses many programs and devices. The execution becomes complicated, and the scan times will increase.

## Setting when the control unit is "degree"

### ■Current value address

The "[Md.20] Current feed value" address is a ring address between 0 and 359.99999°.

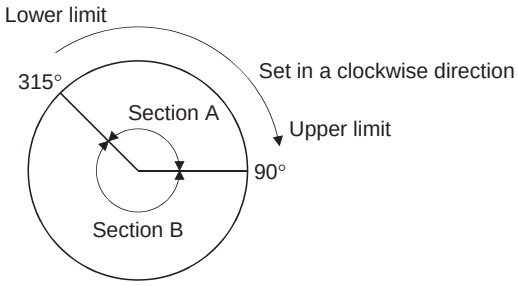



### ■Setting the software stroke limit

The upper limit value/lower limit value of the software stroke limit is a value between 0 and 359.99999°.

- Setting when the software stroke limit is to be validated.

When the software stroke limit is to be validated, set the upper limit value in a clockwise direction from the lower limit value.




Set as follows to set the movement range of section A or B in the above figure.

| Section set as movement range | Software stroke limit lower limit value | Software stroke limit upper limit value |
|---|---|---|
| Section A | 315.00000° | 90.00000° |
| Section B | 90.00000° | 315.00000° |

# Hardware stroke limit function

## ⚠ WARNING

• When the hardware stroke limit is required to be wired, ensure to wire it in the negative logic using b-contact. If it is set in positive logic using a-contact, a serious accident may occur.

In the "hardware stroke limit function", limit switches are set at the upper/lower limit of the physical moveable range, and the control is stopped (by deceleration stop) by the input of a signal from the limit switch.

Damage to the machine can be prevented by stopping the control before the upper/lower limit of the physical moveable range is reached.

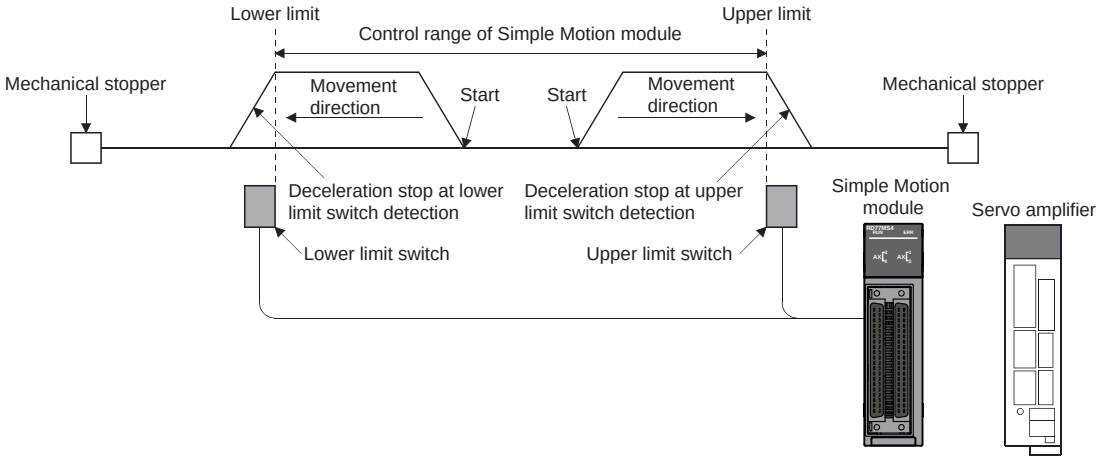
The hardware stroke limit is able to use the following signals. (☞ Page 424 [Pr.116] to [Pr.119] FLS/RLS/DOG/STOP signal selection)

- External input signal of Simple Motion module
- External input signal of servo amplifier
- External input signal via CPU (buffer memory of Simple Motion module)

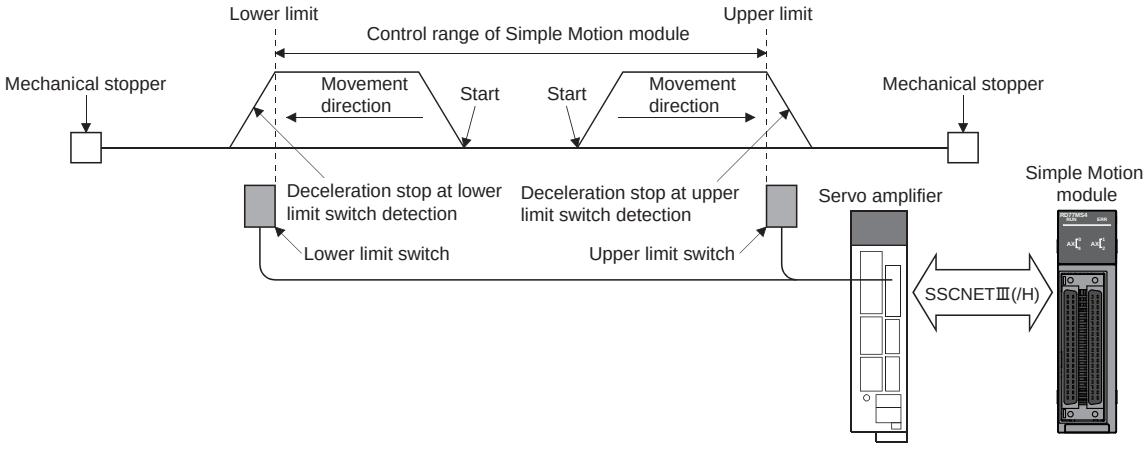
## Control details

The following drawing shows the operation of the hardware stroke limit function.

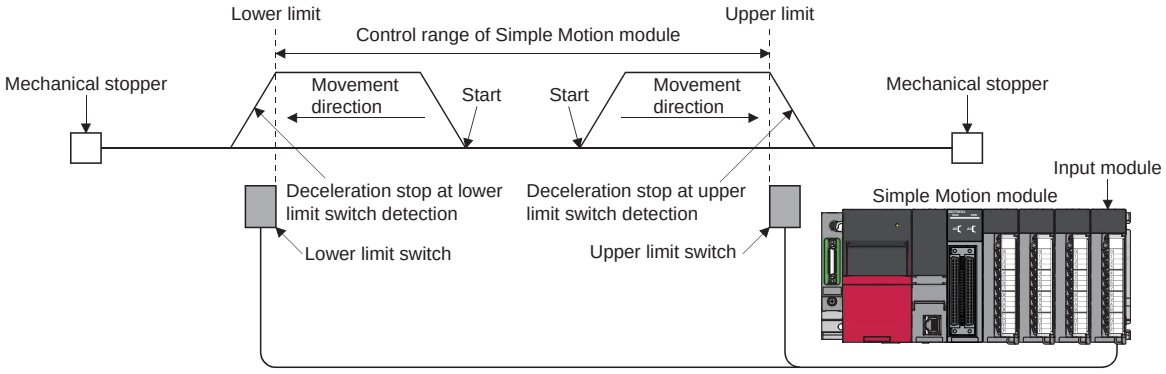
### ■External input signal of Simple Motion module




### ■External input signal of servo amplifier



### ■External input signal via CPU (buffer memory of Simple Motion module)

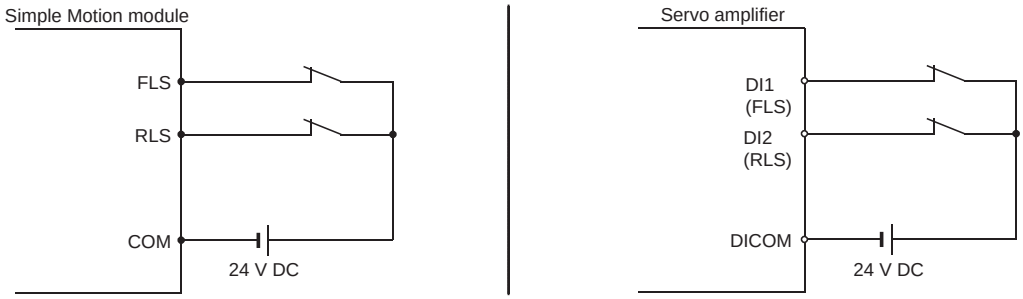



## Wiring the hardware stroke limit

When using the hardware stroke limit function, wire the terminals of the Simple Motion module/servo amplifier upper/lower limit stroke limit as shown in the following drawing. As for the 24 V DC power supply, the direction of current can be switched. (When "[Pr.22] Input signal logic selection" is set to the initial value)

When using the hardware stroke limit function with the external input signal via CPU (buffer memory of Simple Motion module), wiring differs depending on the input module.

*1 When "Servo amplifier" is set in "[Pr.116] FLS signal selection" to "[Pr.118] DOG signal selection" at MR-JE-B use, any errors or warnings do not occur. However, the external input signal (upper/lower limit signal, near-point dog signal) cannot be operated.




**Point**

Wire the limit switch installed in the direction to which "Current feed value" increases as upper limit switch and the limit switch installed in the limit switch installed in the direction to which "Current feed value" decreases as lower limit switch.

If inverting the install positions of upper/lower limit switches, hardware stroke limit function cannot be operated properly. In addition, the servomotor does not stop.

Refer to each servo amplifier instruction manual for details about the "Rotation direction selection/travel direction selection (PA14)".

## Precautions during control

- If the machine is stopped outside the Simple Motion module control range (outside the upper/lower limit switches), or if stopped by hardware stroke limit detection, the starting for the "home position return control", "major positioning control", and "high-level positioning control" and the control mode switching cannot be executed. To carry out these types of control again, return the workpiece to the Simple Motion module control range by a "JOG operation", "inching operation" or "manual pulse generator operation".
- When "[Pr.22] Input signal logic selection" is set to the initial value, the Simple Motion module cannot carry out the positioning control if FLS (limit switch for upper limit) is separated from DICOM or RLS (limit switch for lower limit) is separated from DICOM (including when wiring is not carried out).

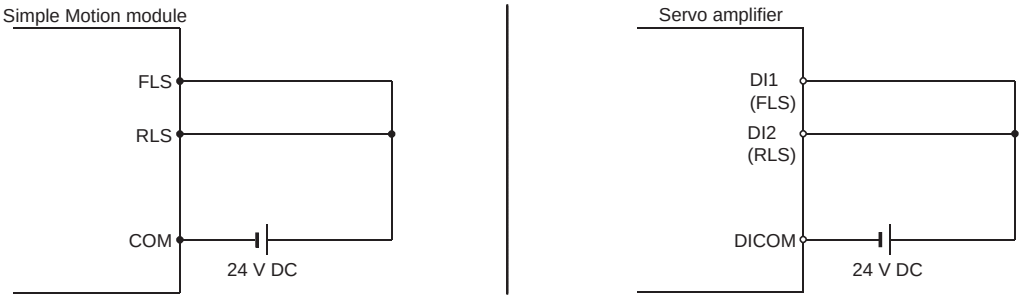
## When the hardware stroke limit function is not used

When not using the hardware stroke limit function, wire the terminals of the Simple Motion module/servo amplifier upper/lower limit stroke limit as shown in the following drawing. As for the 24 V DC power supply, the direction of current can be switched. When the logic of FLS and RLS is set to "positive logic" using "[Pr.22] Input signal logic selection", positioning control can be carried out even if FLS and RLS of the following signals are not wired.

- External input signal of Simple Motion module
- External input signal of servo amplifier
- External input signal via CPU (buffer memory of Simple Motion module)

Refer to the following for details.

☞ Page 308 External Input Signal Select Function



# Forced stop function

## ⚠ WARNING

- When the forced stop is required to be wired, ensure to wire it in the negative logic using b-contact.
- Provided safety circuit outside the Simple Motion module so that the entire system will operate safety even when the "[Pr.82] Forced stop valid/invalid selection" is set "1: Invalid". Be sure to use the forced stop signal (EMI) of the servo amplifier.

"Forced stop function" stops all axes of the servo amplifier with the forced stop input connected to the external input connection connector of the Simple Motion module. (The initial value is "0: Valid".)
The forced stop input valid/invalid is selected by "[Pr.82] Forced stop valid/invalid selection".

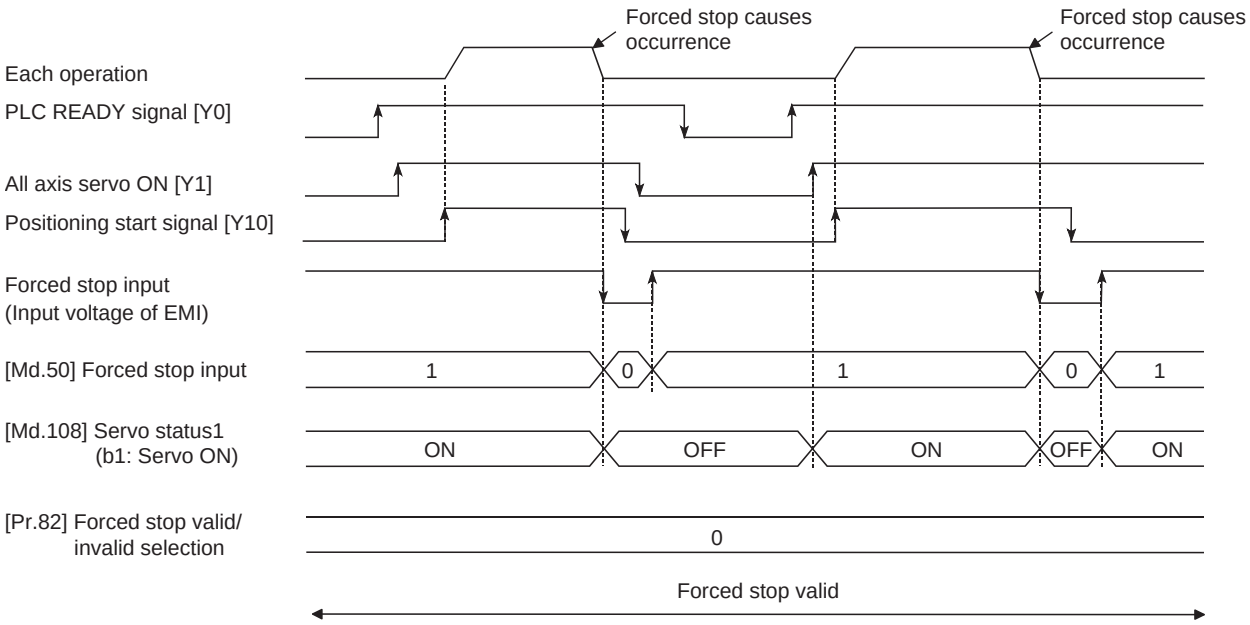
## Control details

The servo warning "Controller forced stop warning" (warning No.: E7) will occur if turned on the forced stop input signal when the "[Pr.82] Forced stop valid/invalid selection" is set "0: Valid". And then it is available for all axes of servo amplifier.
The outline of the forced stop process is shown below.

| Stop cause | | Stop axis | M code ON signal after stop | Axis operation status ([Md.26]) after stopping | Stop process | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Home position return control | | Major positioning control | High-level positioning control | Manual control | |
| | | | | | Machine home position return control | Fast home position return control | | | JOG/ Inching operation | Manual pulse generator operation |
| Forced stop | "Forced stop input signal" OFF | All axes | No change | Servo OFF | Servo OFF or free run (The operation stops with dynamic brake) | | | | | — |

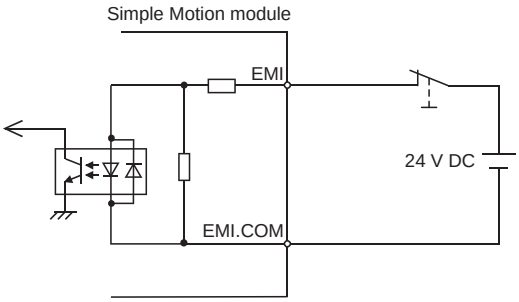
The following drawing shows the operation of the forced stop function.

### ■RD77MS4 operation example



## Wiring the forced stop

When using the forced stop function, wire the terminals of the Simple Motion module forced stop input as shown in the following drawing. As for the 24 V DC power supply, the direction of current can be switched.




## Setting the forced stop

To use the "Forced stop function", set the following data using a program.

The set details are validated at the rising edge (OFF → ON) of the PLC READY signal [Y0].

| Setting item | | Setting value | Setting details | | Buffer memory address |
|---|---|---|---|---|---|
| [Pr.82] | Forced stop valid/ invalid selection | → | Set the forced stop function. | | 35 |
| | | | 0: Valid | Forced stop is used | |
| | | | 1: Invalid | Forced stop is not used | |

Refer to the following for the setting details.

☞ Page 407 Basic Setting

## How to check the forced stop

To use the states (ON/OFF) of forced stop input, set the parameters shown in the following table.

| Monitor item | | Monitor value | Storage details | Buffer memory address |
|---|---|---|---|---|
| [Md.50] | Forced stop input | → | Stores the states (ON/OFF) of forced stop input.<br>0: Forced stop input ON (Forced stop)<br>1: Forced stop input OFF (Forced stop release) | 4231 |

Refer to the following for the setting details.

☞ Page 468 Monitor Data

## Precautions during control

- After the "Forced stop input" is released, the servo ON/OFF is valid for the status of all axis servo ON [Y1].
- If the setting is other than 0 and 1, the error "Forced stop valid/invalid setting error" (error code: 1B71H) occurs.
- The "[Md.50] Forced stop input" is stored "1" by setting "[Pr.82] Forced stop valid/invalid selection" to "1: invalid".
- When the "Forced stop input" is turned ON during operation, the error "Servo READY signal OFF during operation" (error code: 1902H) does not occur.

# 8.5 Functions to Change the Control Details

Functions to change the control details include the "speed change function", "override function", "acceleration/deceleration time change function", "torque change function" and "target position change function". Each function is executed by parameter setting or program creation and writing.

Refer to the following for combination with main function.

MELSEC iQ-R Simple Motion Module User's Manual (Startup)

Both the "speed change function" or "override function" change the speed, but the differences between the functions are shown below. Use the function that corresponds to the application.

"Speed change function"

- The speed is changed at any time, only in the control being executed.
- The new speed is directly set.

"Override function"

- The speed is changed for all control to be executed.
- The new speed is set as a percent (%) of the command speed.

**Point**

"Speed change function" and "Override function" cannot be used in the manual pulse generator operation and speed-torque control.

## Speed change function

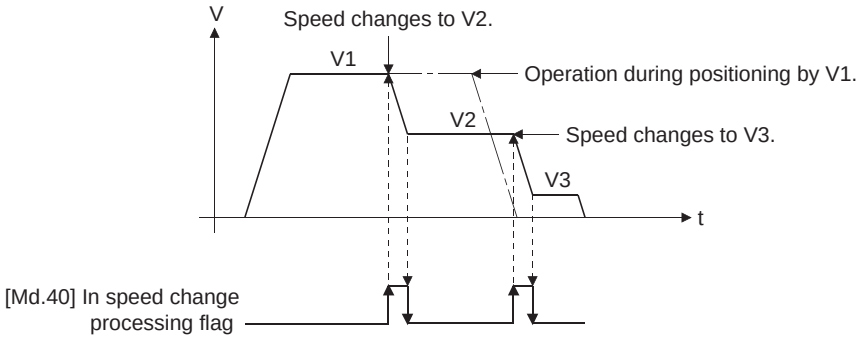
The speed control function is used to change the speed during control to a newly designated speed at any time.

The new speed is directly set in the buffer memory, and the speed is changed by a speed change command ([Cd.15] Speed change request) or external command signal.

During the machine home position return, a speed change to the creep speed cannot be carried out after deceleration start because the near point dog ON is detected. When the speed change function is enabled and the speed is slower than the creep speed, the speed change is disabled and the speed accelerates to the creep speed after the near point dog ON is detected.

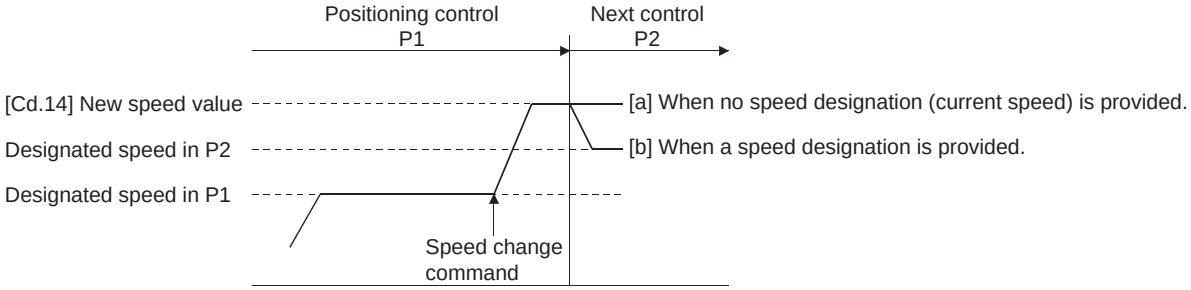
### Control details

The following drawing shows the operation during a speed change.

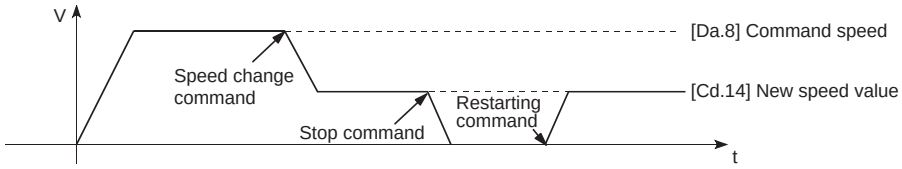


## Precautions during control

- At the speed change during continuous path control, when no speed designation (current speed) is provided in the next positioning data, the next positioning data is controlled at the "[Cd.14] New speed value". Also, when a speed designation is provided in the next positioning data, the next positioning data is controlled at its "[Da.8] Command speed".



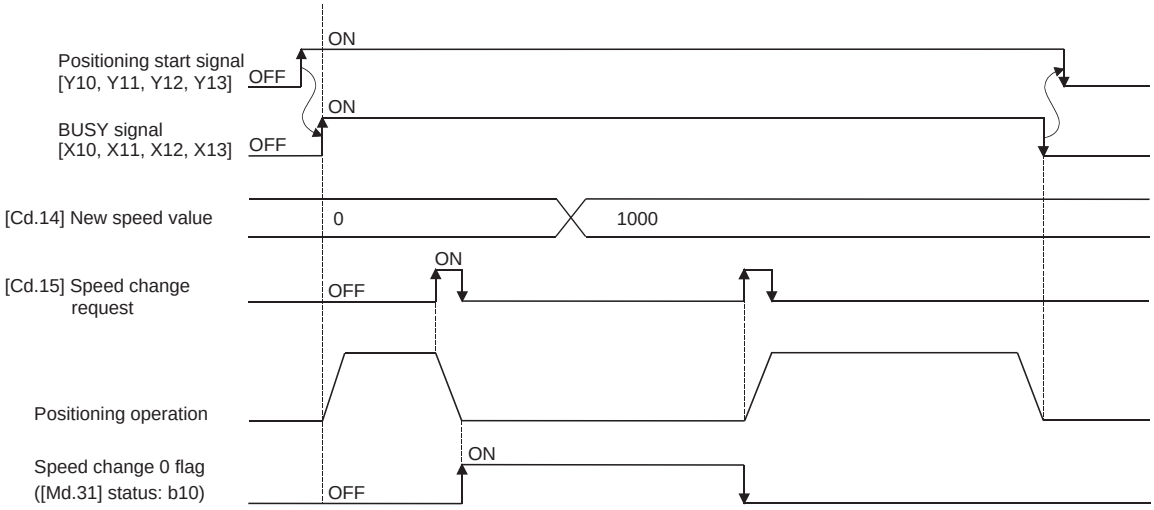

- When changing the speed during continuous path control, the speed change will be ignored if there is not enough distance remaining to carry out the change.
- When the stop command was given to make a stop after a speed change that had been made during position control, the restarting speed depends on the "[Cd.14] New speed value".




- When the speed is changed by setting "[Cd.14] New speed value" to "0", the operation is carried out as follows.

  - When "[Cd.15] Speed change request" is turned ON, the speed change 0 flag ([Md.31] Status: b10) turns ON. (During interpolation control, the speed change 0 flag on the reference axis side turns ON.)
  - The axis stops, but "[Md.26] Axis operation status" does not change, and the BUSY signal remains ON. (If a stop signal is input, the BUSY signal will turn OFF, and "[Md.26] Axis operation status" will change to "stopped".) In this case, setting the "[Cd.14] New speed value" to a value besides "0" will turn OFF the speed change 0 flag ([Md.31] Status: b10), and enable continued operation.

## ■RD77MS4 operation example




- The warning "Deceleration/stop speed change" (warning code: 0990H) occurs and the speed cannot be changed in the following cases.

  - During deceleration by a stop command
  - During automatic deceleration during positioning control

- The warning "Speed limit value over" (warning code: 0991H) occurs and the speed is controlled at the "[Pr.8] Speed limit value" when the value set in "[Cd.14] New speed value" is larger than the "[Pr.8] Speed limit value".
- When the speed is changed during interpolation control, the required speed is set in the reference axis.
- When carrying out consecutive speed changes, be sure there is an interval between the speed changes of 10 ms or more. (If the interval between speed changes is short, the Simple Motion module will not be able to track, and it may become impossible to carry out commands correctly.)
- When a speed change is requested simultaneously for multiple axes, change the speed one by one. Therefore, the start timing of speed change is different for each axis.
- Speed change cannot be carried out during the machine home position return. A request for speed change is ignored.
- When deceleration is started by the speed change function, the deceleration start flag does not turn ON.
- The speed change function cannot be used during speed control mode, torque control mode or continuous operation to torque control mode. Refer to the following for the speed change during speed control mode or continuous operation to torque control mode.

☞ Page 193 Speed-torque Control

## Setting method from the CPU module

The following shows the data settings and program example for changing the control speed of axis 1 by the command from the CPU module. (In this example, the control speed is changed to "20.00 mm/min".)

• Set the following data.

(Set using the program referring to the speed change time chart.)

n: Axis No. - 1

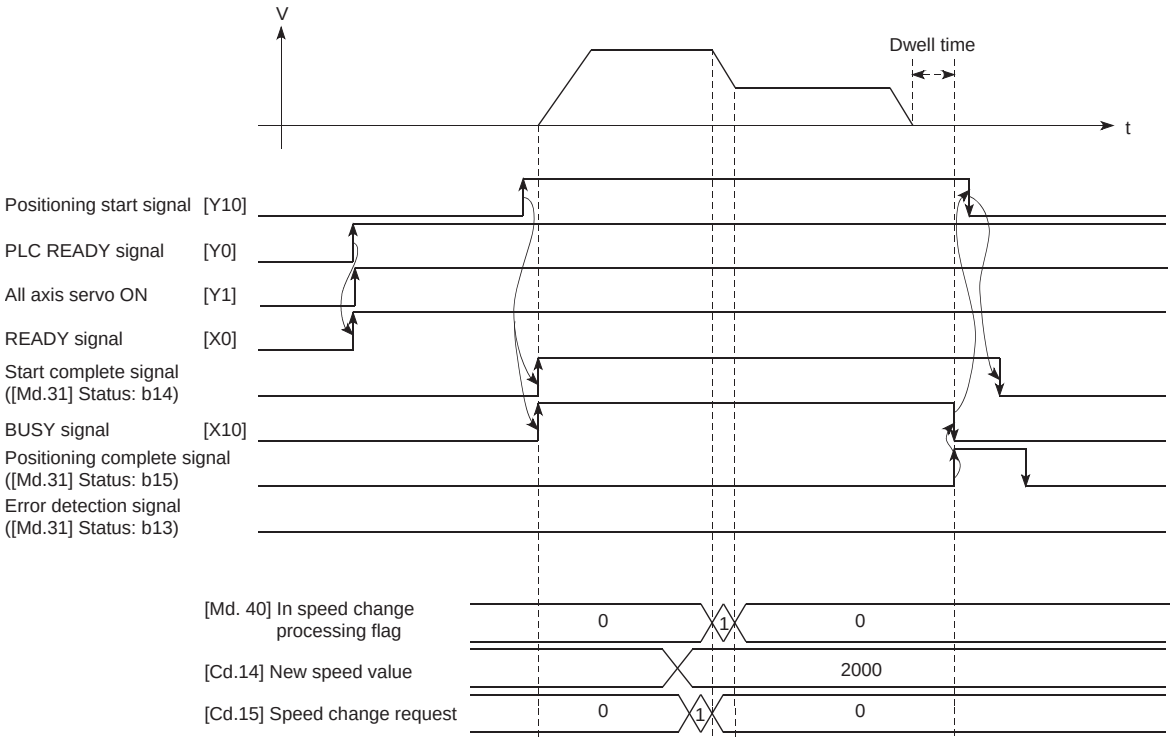
| Setting item | | Setting value | Setting details | Buffer memory address |
|---|---|---|---|---|
| [Cd.14] | New speed value | 2000 | Set the new speed. | 4314+100n<br>4315+100n |
| [Cd.15] | Speed change request | 1 | Set "1: Change the speed". | 4316+100n |

Refer to the following for the setting details.

☞ Page 504 Control Data

• The following shows the speed change time chart.

### ■RD77MS4 operation example




## Program example

Refer to the following for the program example of the speed change program.

☞ Page 569 Speed change program

## Setting method using an external command signal

The speed can also be changed using an "external command signal".

The following shows the data settings and program example for changing the control speed of axis 1 using an "external command signal". (In this example, the control speed is changed to "10000.00 mm/min".)

- Set the following data to change the speed using an external command signal. (Set using the program referring to the speed change time chart.)

n: Axis No. - 1

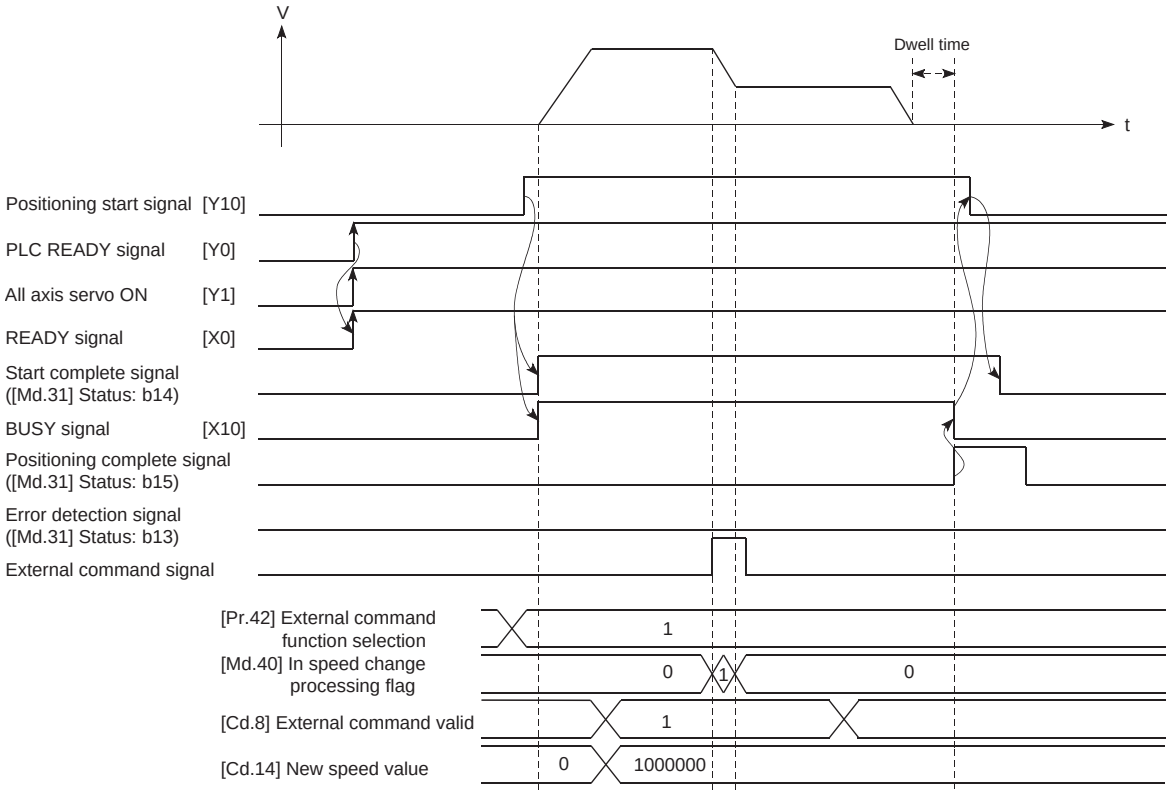
| Setting item | | Setting value | Setting details | Buffer memory address |
|---|---|---|---|---|
| [Pr.42] | External command function selection | 1 | Set "1: External speed change request". | 62+150n |
| [Cd.8] | External command valid | 1 | Set "1: Validate the external command". | 4305+100n |
| [Cd.14] | New speed value | 1000000 | Set the new speed. | 4314+100n<br>4315+100n |

Set the external command signal (D1) in "[Pr.95] External command signal selection". Refer to the followings for the setting details.

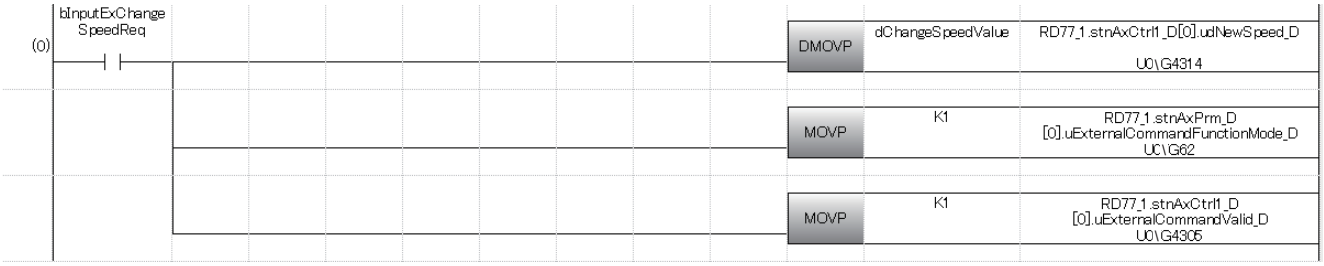
☞ Page 407 Basic Setting, Page 504 Control Data

- The following shows the speed change time chart.

### ■RD77MS4 operation example



• Add the following program to the control program, and write it to the CPU module.




| Classification | Label name | Description |
|---|---|---|
| Module label | RD77_1.stnAxPrm_D[0].uExternalCommandFunctionMode_D | Axis 1 External command function selection |
| | RD77_1.stnAxCtrl1_D[0].uExternalCommandValid_D | Axis 1 External command valid |
| | RD77_1.stnAxCtrl1_D[0].udNewSpeed_D | Axis 1 New speed value |
| Global label, local label | Defines the global label or the local label as follows. The settings of Assign (Device/Label) are not required for the label that the assignment device is not set because the unused internal relay and data device are automatically assigned. | |

| | Label Name | Data Type | | Class |
|---|---|---|---|---|
| 1 | dChangeSpeedValue | Double Word [Unsigned]/Bit String [32-bit] | ... | VAR |
| 2 | bInputExChangeSpeedReq | Bit | ... | VAR |
| 3 | | | ... | |

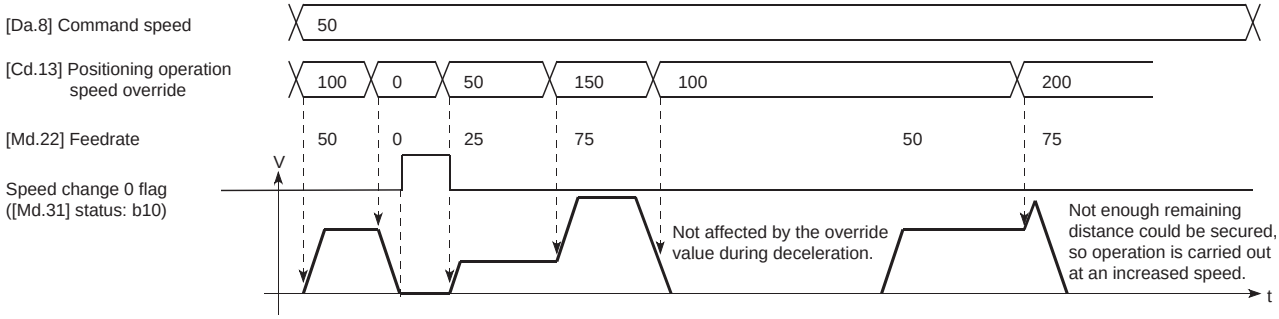
# Override function

The override function changes the command speed by a designated percentage (0 to 300%) for all control to be executed. The speed can be changed by setting the percentage (%) by which the speed is changed in "[Cd.13] Positioning operation speed override".

## Control details

The following shows that operation of the override function.

- A value changed by the override function is monitored by "[Md.22] Feedrate".
- If "[Cd.13] Positioning operation speed override" is set to 100%, the speed will not change.
- If "[Cd.13] Positioning operation speed override" is set with a value less than "100 (%)" and "[Md.22] Feedrate" is less than "1", the warning "Less than minimum speed" (warning code: 0904H) occurs and "[Md.22] Feedrate" is set with "1" in any speed unit.
- If "[Cd.13] Positioning operation speed override" is set to "0 (%)", the speed is set to "0" and the speed change 0 flag ([Md.31] Status: b10) is set to "1". At the time, the warning "Less than minimum speed" (warning code: 0904H) does not occur.
- If there is not enough remaining distance to change the speed due to the "override function", when the speed is changed during the position control of speed-position switching control or position-speed switching control, the operation will be carried out at the speed that could be changed.
- If the speed changed by the override function is greater than the "[Pr.8] Speed limit value", the warning "Speed limit value over" (warning code: 0991H) will occur and the speed will be controlled at the "[Pr.8] Speed limit value". The "[Md.39] In speed limit flag" will turn ON.




## Precaution during control

- When changing the speed by the override function during continuous path control, the speed change will be ignored if there is not enough distance remaining to carry out the change.
- The warning "Deceleration/stop speed change" (warning code: 0990H) occurs and the speed cannot be changed by the override function in the following cases. (The value set in "[Cd.13] Positioning operation speed override" is validated after a deceleration stop.)

  - During deceleration by a stop command
  - During automatic deceleration during positioning control

- When the speed is changed by the override function during interpolation control, the required speed is set in the reference axis.
- When carrying out consecutive speed changes by the override function, be sure there is an interval between the speed changes of 10 ms or more. (If the interval between speed changes is short, the Simple Motion module will not be able to track, and it may become impossible to carry out commands correctly.)
- When a machine home position return is performed, the speed change by the override function cannot be carried out after a deceleration start to the creep speed following the detection of near-point dog ON. When the override is enabled during home position return and the speed is changed, the override is disabled and the speed accelerates to the creep speed after the near point dog ON is detected.
- When deceleration is started by the override function, the deceleration start flag does not turn ON.
- The override function cannot be used during speed control mode, torque control mode or continuous operation to torque control mode.

## Setting method

The following shows the data settings and program example for setting the override value of axis 1 to "200%".

- Set the following data. (Set using the program referring to the speed change time chart.)

n: Axis No. - 1

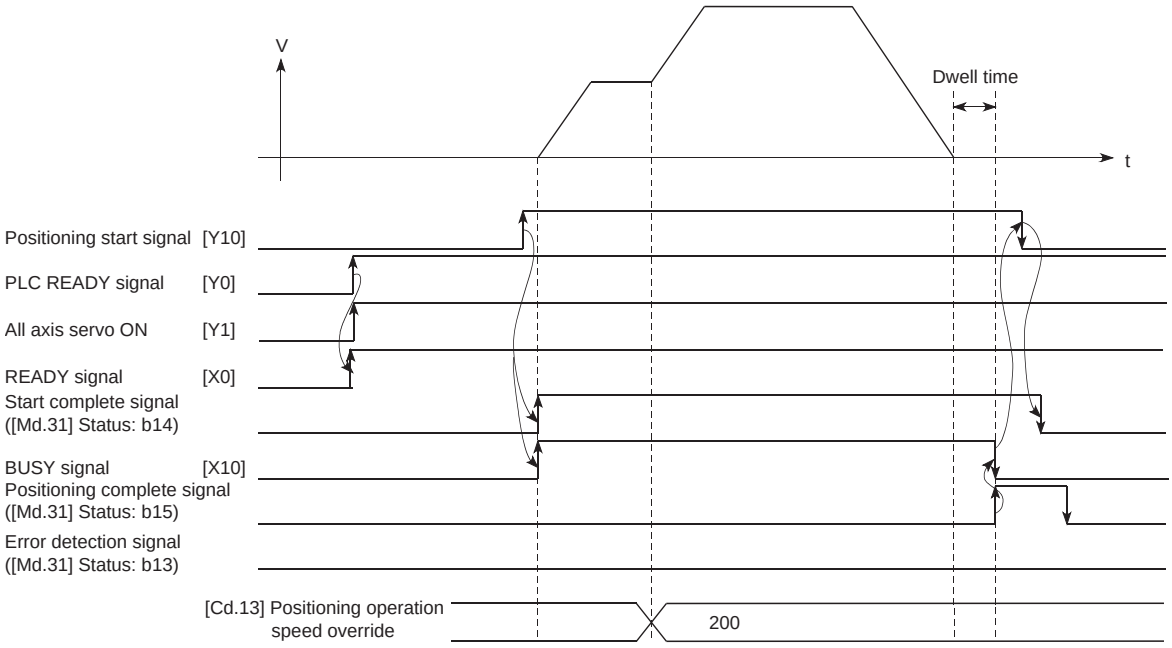
| Setting item | | Setting value | Setting details | Buffer memory address |
|---|---|---|---|---|
| [Cd.13] | Positioning operation speed override | 200 | Set the new speed as a percentage (%). | 4313+100n |

Refer to the following for the setting details.

☞ Page 504 Control Data

- The following shows a time chart for changing the speed using the override function.

### ■RD77MS4 operation example




- Add the following program to the control program, and write it to the CPU module.

☞ Page 569 Override program

# Acceleration/deceleration time change function

The "acceleration/deceleration time change function" is used to change the acceleration/deceleration time during a speed change to a random value when carrying out the speed change by the "speed change function" and "override function".
In a normal speed change (when the acceleration/deceleration time is not changed), the acceleration/deceleration time previously set in the parameters ([Pr.9], [Pr.10], and [Pr.25] to [Pr.30] values) is set in the positioning parameter data items [Da.3] and [Da.4], and control is carried out with that acceleration/deceleration time. However, by setting the new acceleration/deceleration time ([Cd.10], [Cd.11]) in the control data, and issuing an acceleration/deceleration time change enable command ([Cd.12] Acceleration/deceleration time change value during speed change, enable/disable) to change the speed when the acceleration/deceleration time change is enabled, the speed will be changed with the new acceleration/deceleration time ([Cd.10], [Cd.11]).

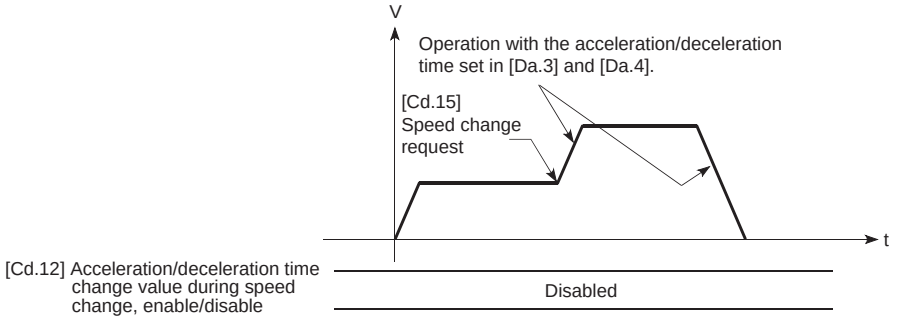
## Control details

After setting the following two items, carry out the speed change to change the acceleration/deceleration time during the speed change.

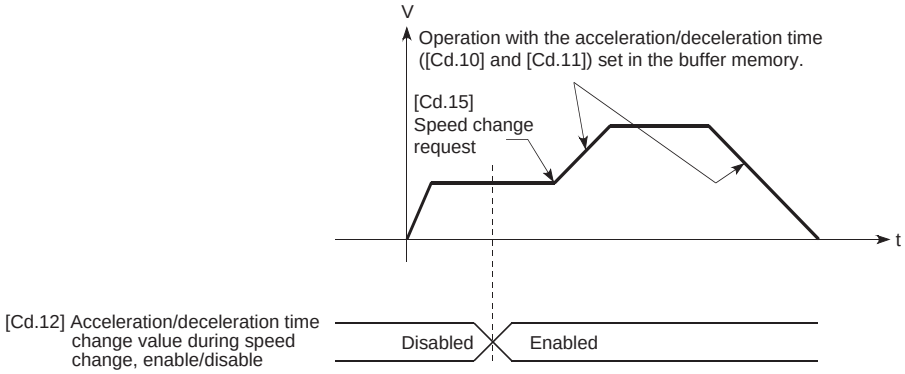
- Set change value of the acceleration/deceleration time ("[Cd.10] New acceleration time value", "[Cd.11] New deceleration time value")
- Setting acceleration/deceleration time change to enable ("[Cd.12] Acceleration/deceleration time change value during speed change, enable/disable")

The following drawing shows the operation during an acceleration/deceleration time change.

[For an acceleration/deceleration time change disable setting]


V
Operation with the acceleration/deceleration time set in [Da.3] and [Da.4].
[Cd.15] Speed change request
t
[Cd.12] Acceleration/deceleration time change value during speed change, enable/disable
Disabled

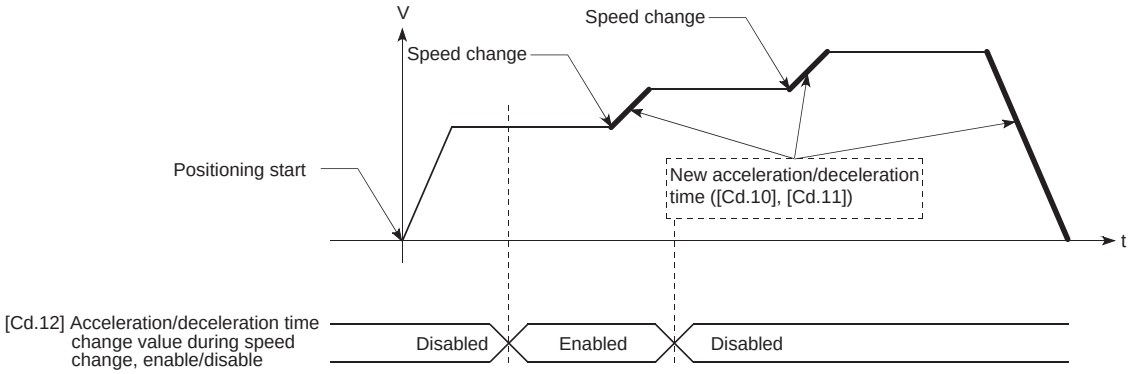
[For an acceleration/deceleration time change enable setting]


V
Operation with the acceleration/deceleration time ([Cd.10] and [Cd.11]) set in the buffer memory.
[Cd.15] Speed change request
t
[Cd.12] Acceleration/deceleration time change value during speed change, enable/disable
Disabled
Enabled

## Precautions during control

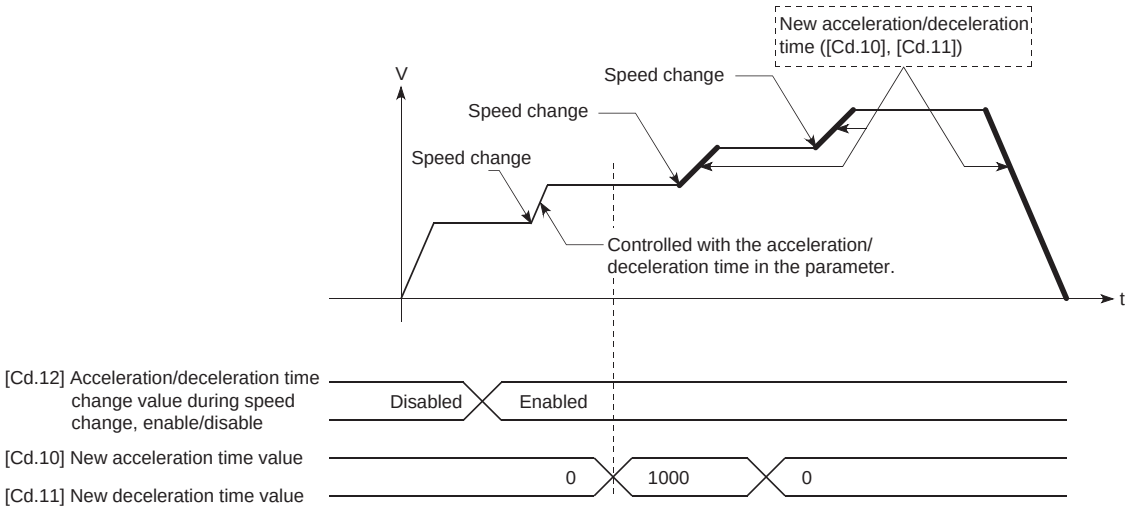
- When "0" is set in "[Cd.10] New acceleration time value" and "[Cd.11] New deceleration time value", the acceleration/deceleration time will not be changed even if the speed is changed. In this case, the operation will be controlled at the acceleration/deceleration time previously set in the parameters.
- The "new acceleration/deceleration time" is valid during execution of the positioning data for which the speed was changed. In continuous positioning control and continuous path control, the speed is changed and control is carried out with the previously set acceleration/deceleration time at the changeover to the next positioning data, even if the acceleration/deceleration time is changed to the "new acceleration/deceleration time ([Cd.10], [Cd.11])".
- Even if the acceleration/deceleration time change is set to disable after the "new acceleration/deceleration time" is validated, the positioning data for which the "new acceleration/deceleration time" was validated will continue to be controlled with that value. (The next positioning data will be controlled with the previously set acceleration/deceleration time.)

**Ex.**




- If the "new acceleration/deceleration time" is set to "0" and the speed is changed after the "new acceleration/deceleration time" is validated, the operation will be controlled with the previous "new acceleration/deceleration time".

**Ex.**




- The acceleration/deceleration change function cannot be used during speed control mode, torque control mode or continuous operation to torque control mode. Refer to the following for the acceleration/deceleration processing during speed control mode or continuous operation to torque control mode.

☞ Page 193 Speed-torque Control

**Point**

If the speed is changed when an acceleration/deceleration change is enabled, the "new acceleration/deceleration time" will become the acceleration/deceleration time of the positioning data being executed. The "new acceleration/deceleration time" remains valid until the changeover to the next positioning data. (The automatic deceleration processing at the completion of the positioning will also be controlled by the "new acceleration/deceleration time".)

## Setting method

To use the "acceleration/deceleration time change function", write the data shown in the following table to the Simple Motion module using the program.

The set details are validated when a speed change is executed after the details are written to the Simple Motion module.

n: Axis No. - 1

| Setting item | | Setting value | Setting details | Buffer memory address |
|---|---|---|---|---|
| [Cd.10] | New acceleration time value | → | Set the new acceleration time. | 4308+100n<br>4309+100n |
| [Cd.11] | New deceleration time value | → | Set the new deceleration time. | 4310+100n<br>4311+100n |
| [Cd.12] | Acceleration/deceleration time change value during speed change, enable/disable | 1 | Set "1: Acceleration/deceleration time change enable". | 4312+100n |

Refer to the following for the setting details.

☞ Page 504 Control Data

Add the following program to the control program, and write it to the CPU module.

☞ Page 569 Acceleration/deceleration time change program

# Torque change function

The "torque change function" is used to change the torque limit value during torque limiting.

The torque limit value at the control start is the value set in the "[Pr.17] Torque limit setting value" or "[Cd.101] Torque output setting value".

The following two change methods in the torque change function.

| Torque change function | Details |
|---|---|
| Forward/reverse torque limit value same setting | The forward torque limit value and reverse torque limit value are changed to the same value by the new torque value. (Use this method when they need not be separately set.) |
| Forward/reverse torque limit value individual setting | The forward torque limit value and reverse torque limit value are individually changed respectively by the forward new torque value and reverse new torque value. |

*1 Forward torque limit value: The limit value to the generated torque during CW regeneration at the CCW driving of the servo motor.
Reverse torque limit value: The limit value to the generated torque during CCW regeneration at the CW driving of the servo motor.

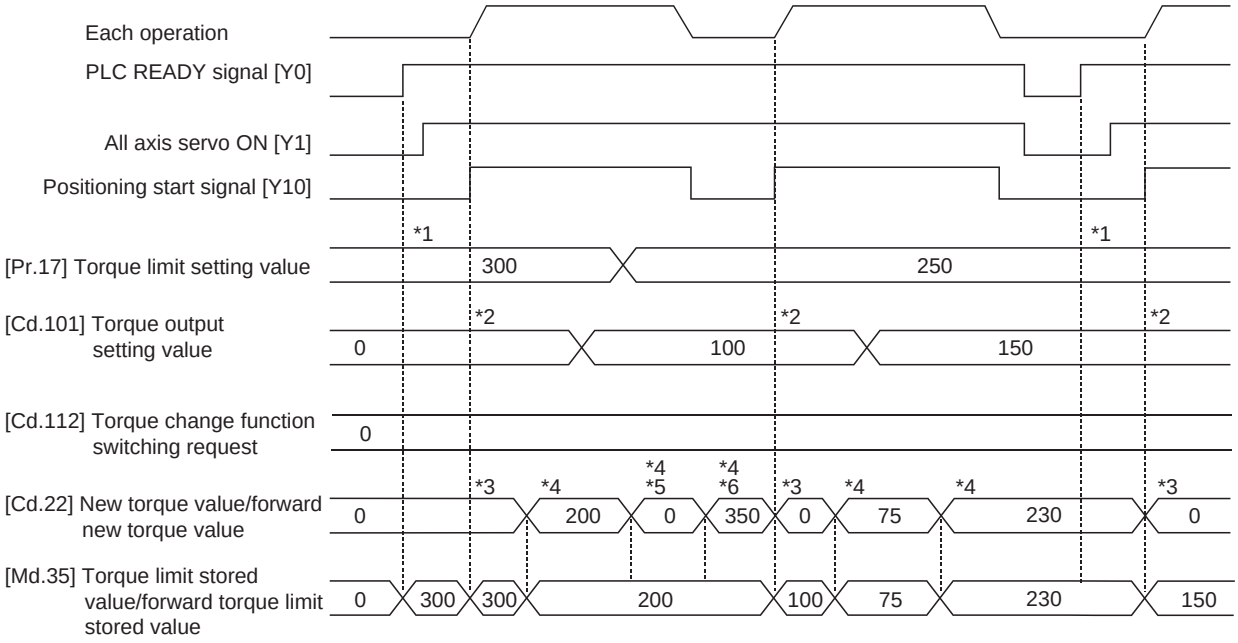
Set previously "same setting" or "individual setting" of the forward/reverse torque limit value in "[Cd.112] Torque change function switching request". Set the new torque value (forward new torque value/reverse new torque value) in the axis control data ([Cd.22] or [Cd.113]) shown below.

| Torque change function | Setting items | | |
|---|---|---|---|
| | Torque change function switching request ([Cd.112]) | New torque value ([Cd.22], [Cd.113]) | |
| Forward/reverse torque limit value same setting | 0: Forward/reverse torque limit value same setting | [Cd.22] | New torque value/forward new torque value |
| | | [Cd.113] | Setting invalid |
| Forward/reverse torque limit value individual setting | 1: Forward/reverse torque limit value individual setting | [Cd.22] | New torque value/forward new torque value |
| | | [Cd.113] | Reverse new torque value |

## Control details

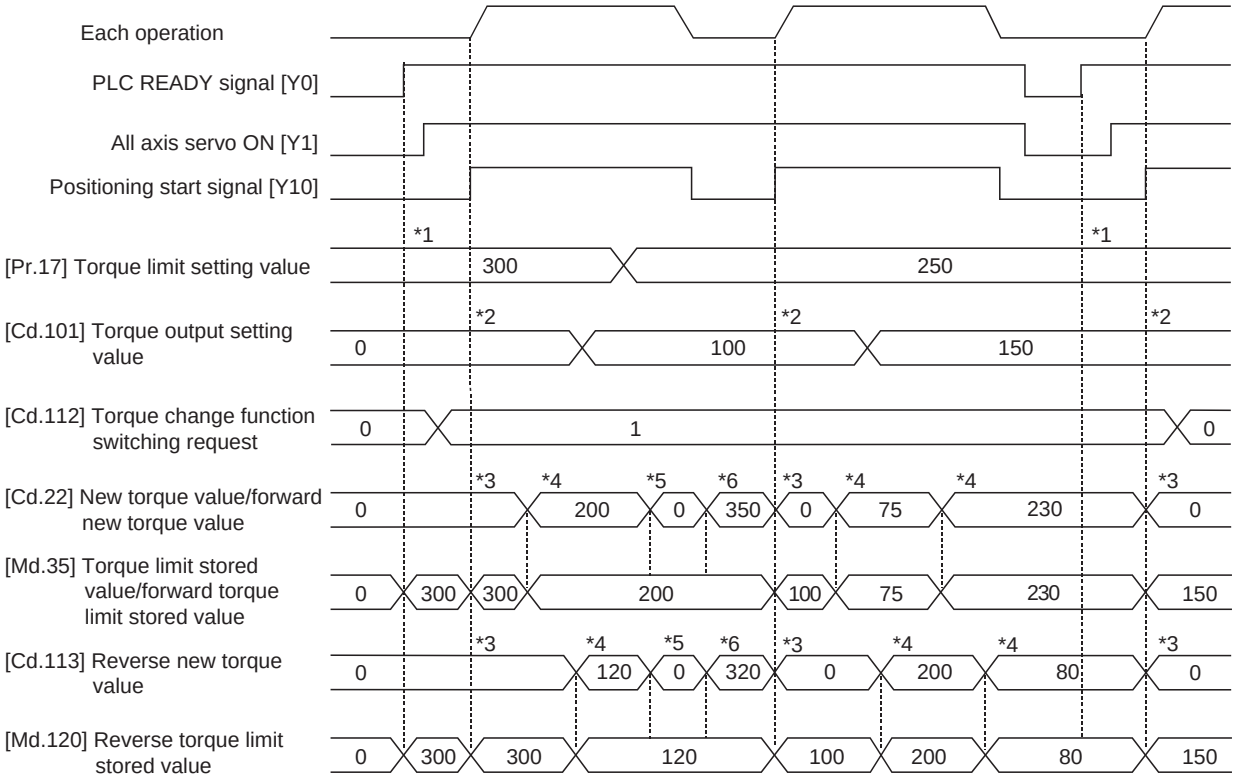
The torque value (forward new torque value/reverse new torque value) of the axis control data can be changed at all times.
The torque can be limited with a new torque value from the time the new torque value has been written to the Simple Motion module.
Note that the delay time until a torque control is executed is max. operation cycle after torque change value was written.
The toque limiting is not carried out from the time the power supply is turned ON to the time the PLC READY signal [Y0] is turned ON.
The new torque value ([Cd.22], [Cd.113]) is cleared to zero at the leading edge (OFF to ON) of the positioning start signal [Y10].
The torque setting range is from 0 to "[Pr.17] Torque limit setting value". (When the setting value is 0, a torque change is considered not to be carried out, and it becomes to the value set in "[Pr.17] Torque limit setting value" or "[Cd.101] Torque output setting value". The torque change range is 1 to "[Pr.17] Torque limit setting value".)
The following drawing shows the operation at the same setting and the operation at the individual setting for the forward new torque value and reverse new torque value.

### ■RD77MS4 operation example




*1 The torque limit setting value or torque output setting value becomes effective at the PLC READY signal [Y0] rising edge (however, after the servo turned ON.)
If the torque output setting value is "0" or larger than the torque limit setting value, the torque limit setting value will be its value.
*2 The torque limit setting value or torque output setting value becomes effective at the positioning start signal [Y10] rising edge, and the torque limit value is updated.
If the torque output setting value is "0" or larger than the torque limit setting value, the torque limit setting value will be its value.
*3 The torque change value is cleared to "0" at the positioning start signal [Y10] rising edge.
*4 The torque limit value is changed by the torque changed value.
*5 When the new torque value is 0, a torque change is considered not to be carried out.
*6 When the change value exceeds the torque limit value, a torque change is considered not to be carried out.

### ■RD77MS4 operation example




*1 The torque limit setting value or torque output setting value becomes effective at the PLC READY signal [Y0] rising edge (however, after the servo turned ON.)

*2 The torque limit setting value or torque output setting value becomes effective at the positioning start signal [Y10] rising edge, and the torque limit value is updated.

*3 The torque change value is cleared to "0" at the positioning start signal [Y10] rising edge.

*4 The torque limit value is changed by the torque changed value.

*5 When the new torque value is 0, a torque change is considered not to be carried out.

*6 When the change value exceeds the torque limit value, a torque change is considered not to be carried out.

## Precautions during control

- If a value besides "0" is set in the new torque value, the torque generated by the servomotor will be limited by the setting value. To limit the torque with the value set in "[Pr.17] Torque limit setting value" or "[Cd.101] Torque output setting value", set "0" to the new torque value.

| Setting value of "[Cd.112] Torque change function switching request" | Setting item (New torque value) |
|---|---|
| 0: Forward/reverse torque limit value same setting | [Cd.22] New torque value/forward new torque value |
| 1: Forward/reverse torque limit value individual setting | [Cd.22] New torque value/forward new torque value |
| | [Cd.113] Reverse new torque value |

- The "[Cd.22] New torque value/forward new torque value" or "[Cd.113] Reverse new torque value" is validated when written to the Simple Motion module. (Note that it is not validated from the time the power supply is turned ON to the time the PLC READY signal [Y0] is turned ON.)
- If the setting value of "[Cd.22] New torque value/forward new torque value" is outside the setting range, the warning "Outside new torque value range/outside forward new torque value range" (warning code: 0907H) will occur and the torque will not be changed. If the setting value of "[Cd.113] Reverse new torque value" is outside the setting range, the warning "Outside reverse new torque value range" (warning code: 0932H) will occur and the torque will not be changed.
- If the time to hold the new torque value is not more than 10 ms, a torque change may not be executed.
- When changing from "0: Forward/reverse torque limit value same setting" to "1: Forward/reverse torque limit value individual setting" by the torque change function, set "0" or same value set in "[Cd.22] New torque value/forward new torque value" in "[Cd.113] Reverse new torque value" before change.

## Setting method

To use the "torque change function", write the data shown in the following table to the Simple Motion module using the program.

The set details are validated when written to the Simple Motion module.

n: Axis No. - 1

| Setting item | | Setting value | Setting details | Buffer memory address |
|---|---|---|---|---|
| [Cd.112] | Torque change function switching request | 0: Forward/reverse torque limit value same setting<br>1: Forward/reverse torque limit value individual setting | Sets "same setting/individual setting" of the forward torque limit value and reverse torque limit value.<br>: Set "0" normally. (When the forward torque limit value and reverse torque limit value are not divided.)<br>: When a value except "1" is set, it operates as "forward/reverse torque limit value same setting". | 4363+100n |
| [Cd.22] | New torque value/forward new torque value | 0 to [Pr.17] Torque limit setting value | When "0" is set to "[Cd.112] Torque change function switching request", a new torque limit value is set. (This value is set to the forward torque limit value and reverse torque limit value.)<br>When "1" is set to "[Cd.112] Torque change function switching request", a new forward torque limit value is set. | 4325+100n |
| [Cd.113] | Reverse new torque value | 0 to [Pr.17] Torque limit setting value | "1" is set in "[Cd.112] Torque change function switching request", a new reverse torque limit value is set.<br>: When "0" is set in "[Cd.112] Torque change function switching request", the setting value is invalid. | 4364+100n |

Refer to the following for the setting details.

☞ Page 504 Control Data

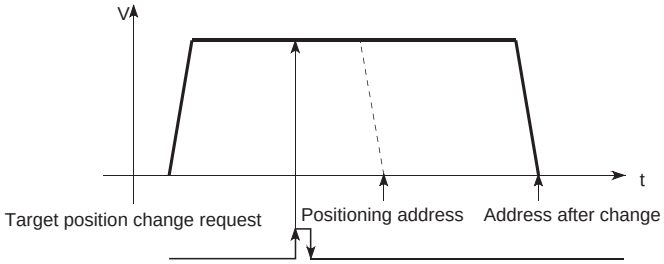
# Target position change function

The "target position change function" is a function to change a target position to a newly designated target position at any timing during the position control (1-axis linear control). A command speed can also be changed simultaneously.
The target position and command speed changed are set directly in the buffer memory, and the target position change is executed by "[Cd.29] Target position change request flag".

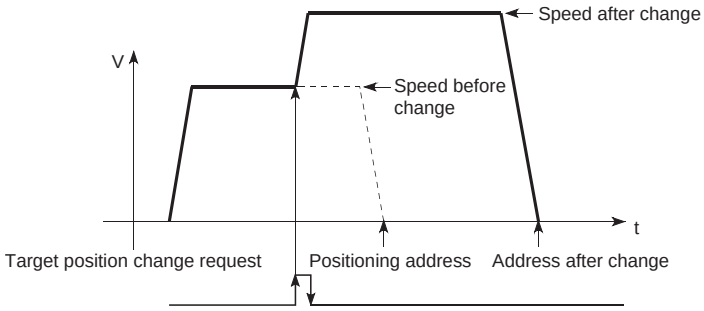
## Details of control

The following charts show the details of control of the target position change function.

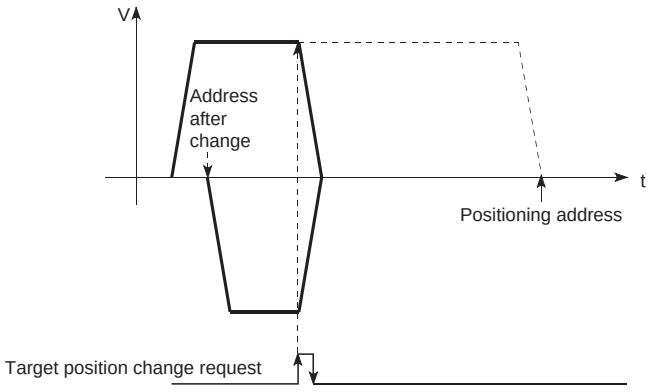
### ■When the address after change is positioned away from the start point more than the positioning address:




### ■When the speed is changed simultaneously with changing the address:




### ■When the direction of the operation is changed:



## Precautions during operation

- If the positioning movement direction from the stop position to a new target position is reversed, stop the operation once and then position to the new target position. (☞ Page 263 When the direction of the operation is changed:)
- If a command speed exceeding the speed limit value is set to change the command speed, the warning "Speed limit value over" (warning code: 0991H) will occur and the new command speed will be the speed limit value. Also, if the command speed change disables the remaining distance to the target value from being assured, the warning "Insufficient remaining distance" will occur (warning code: 0994H, 0995H).
- In the following cases, a target position change request given is ignored and the warning "Target position change not possible" (warning code: 099BH to 09A1H) occurs.

  - During interpolation control
  - While a new target position value (address) is outside the software stroke limit range
  - While decelerating to a stop by a stop cause
  - While the positioning data whose operation pattern is continuous path control is executed
  - While the speed change 0 flag ([Md.31] Status: b10) is turned ON

- When a command speed is changed, the current speed is also changed. When the next positioning speed uses the current speed in the continuous positioning, the next positioning operation is carried out at the new speed value. When the speed is set with the next positioning data, the speed becomes the current speed and the operation is carried out at the current speed.
- When a target position change request is given during automatic deceleration in position control and the movement direction is reversed, the positioning control to a new position is performed after the positioning has stopped once. If the movement direction is not reversed, the speed accelerates to the command speed again and the positioning to the new position is performed.
- If the constant speed status is regained or the output is reversed by a target position change made while "[Md.48] Deceleration start flag" is ON, the deceleration start flag remains ON. (☞ Page 294 Deceleration start flag function)
- Carrying out the target position change to the ABS linear 1 in degrees may carry out the positioning to the new target position after the operation decelerates to stop once, even the movement direction is not reversed.

**Restriction**

When carrying out the target position change continuously, take an interval of 10 ms or longer between the times of the target position changes. Also, take an interval of 10 ms or longer when the speed change and override is carried out after changing the target position or the target position change is carried out after the speed change and override.

## Setting method from the CPU module

The following shows the data settings and program example for changing the target position of axis 1 by the command from the CPU module. (In this example, the target position value is changed to "300.0 μm" and the command speed is changed to "10000.00 mm/min".)

• The following data is set. (Set using the program referring to the target position change time chart.)

n: Axis No. - 1

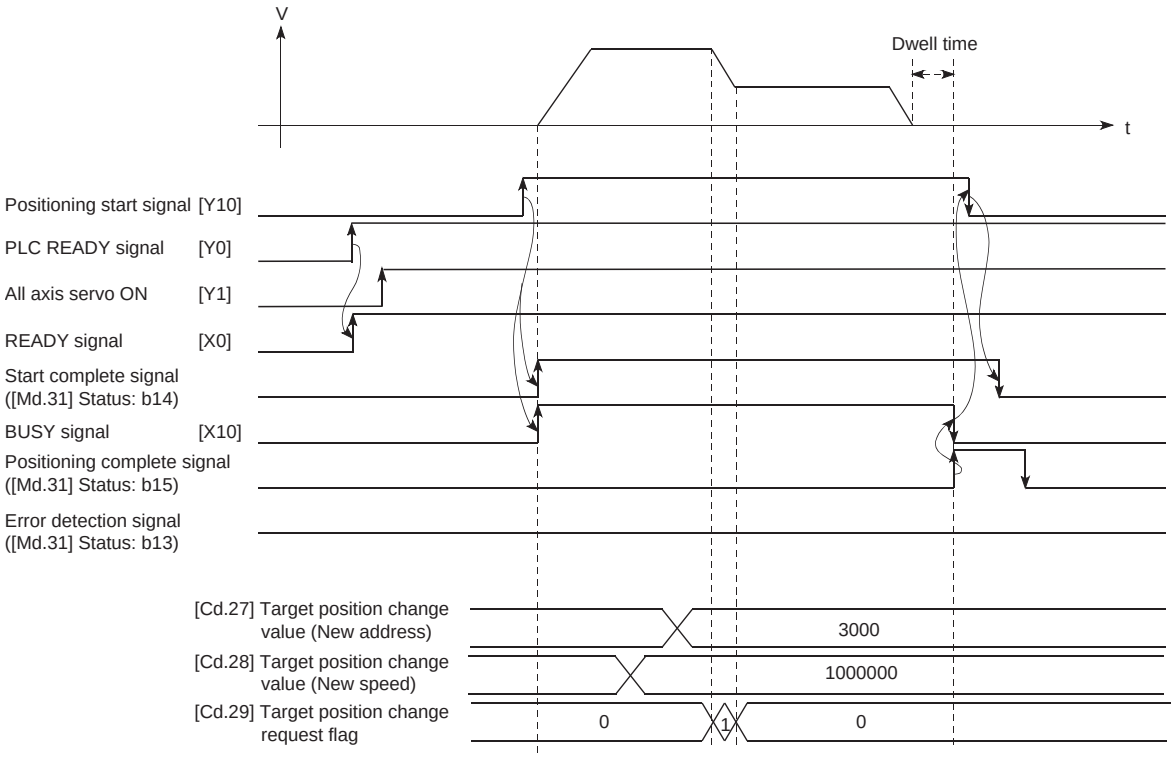
| Setting item | | Setting value | Setting details | Buffer memory address |
|---|---|---|---|---|
| [Cd.27] | Target position change value (New address) | 3000 | Set the new address. | 4334+100n<br>4335+100n |
| [Cd.28] | Target position change value (New speed) | 1000000 | Set the new speed. | 4336+100n<br>4337+100n |
| [Cd.29] | Target position change request flag | 1 | Set "1: Requests a change in the target position". | 4338+100n |

Refer to the following for details on the setting details.

☞ Page 504 Control Data

• The following shows the time chart for target position change.

### ■RD77MS4 operation example




• Add the following program to the control program, and write it to the CPU module.

☞ Page 571 Target position change program

# 8.6 Functions Related to Start

A function related to start includes the "pre-reading start function". This function is executed by parameter setting or program creation and writing.

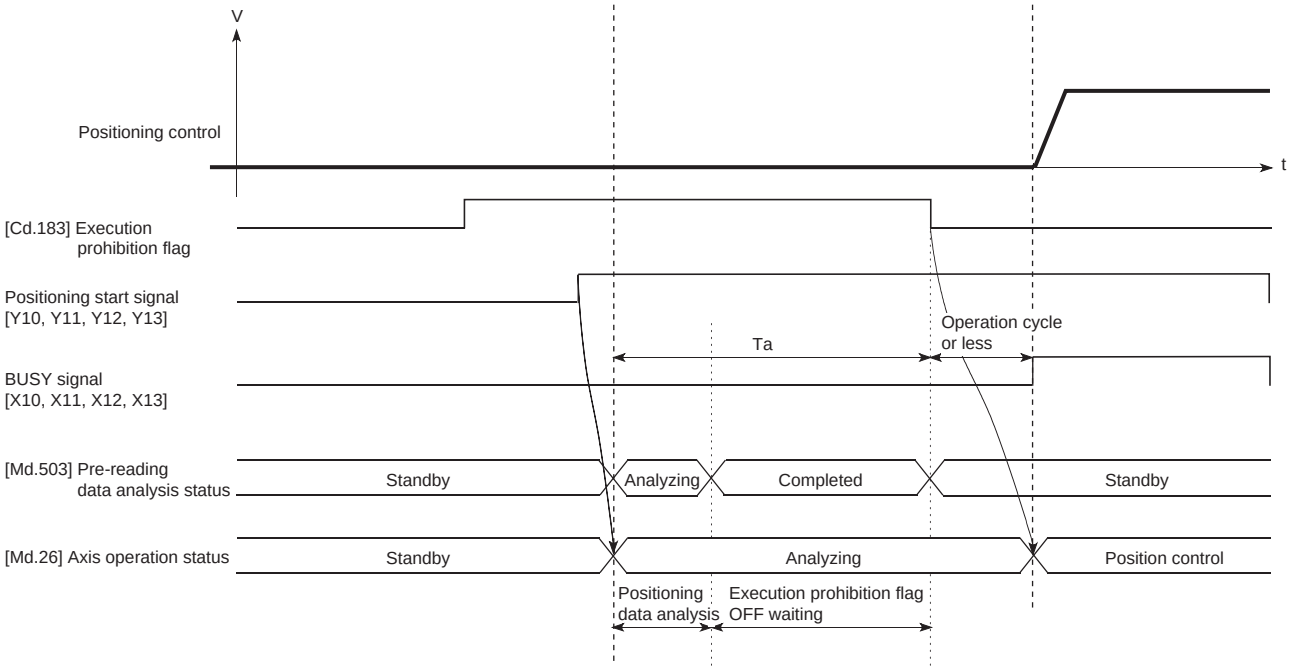
## Pre-reading start function

The "pre-reading start function" does not start servo while the execution prohibition flag is ON if a positioning start request is given with the execution prohibition flag ON, and starts servo within operation cycle after OFF of the execution prohibition flag is detected. The positioning start request is given when the axis is in a standby status, and the execution prohibition flag is turned OFF at the axis operating timing.

### Controls

The pre-reading start function is performed by turning ON the positioning start signal with the execution prohibition flag [Cd.183] ON. However, if positioning is started with the execution prohibition flag ON, the positioning data is analyzed but servo start is not provided. While the execution prohibition flag is ON, "[Md.26] Axis operation status" remains unchanged from "5: Analyzing". The servo starts within operation cycle after the execution prohibition flag has turned OFF, and "[Md.26] Axis operation status" changes to the status (e.g. position control, speed control) that matches the control method. Turn OFF the execution prohibition flag after "2: Completed" is set to "[Md.503] Pre-reading data analysis status". (Refer to the following figure.)

**■RD77MS4 operation example**

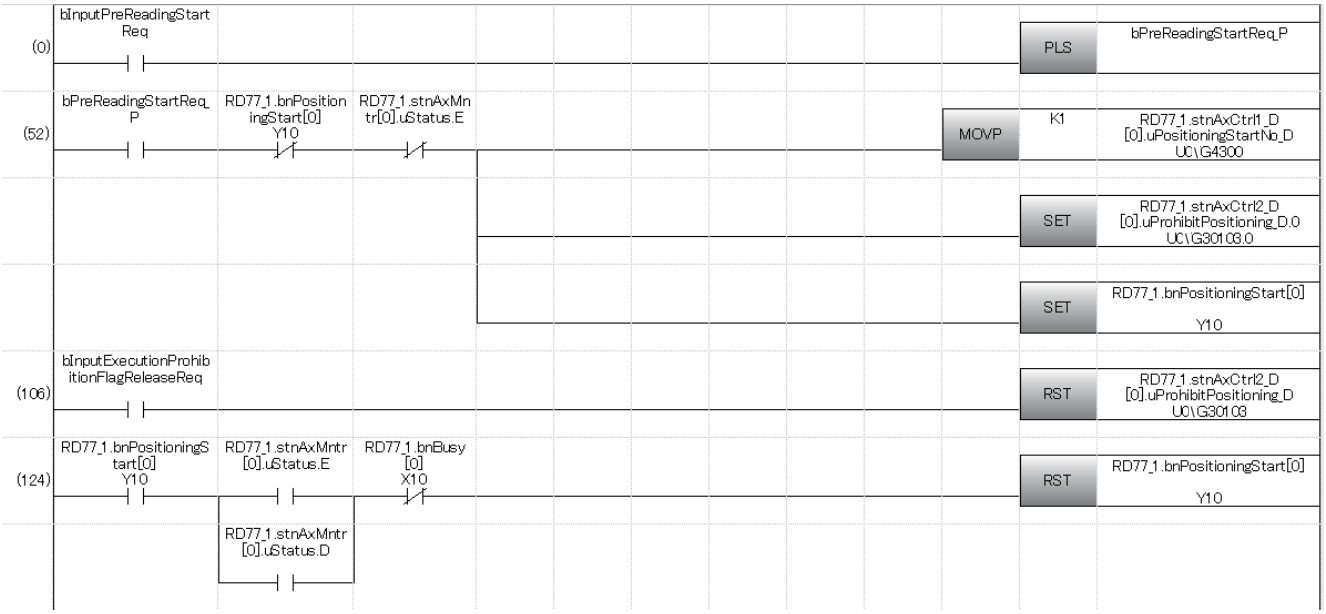


## Precautions during control

- After positioning data analysis, the system is put in an execution prohibition flag OFF waiting status. Any change made to the positioning data in the execution prohibition flag OFF waiting status is not reflected on the positioning data. Change the positioning data before turning ON the positioning start signal.
- The pre-reading start function is invalid if the execution prohibition flag is turned OFF between when the positioning start signal has turned ON and when positioning data analysis is completed (Ta < start time, Ta: Reference to the above figure).
- The data No. which can be executed positioning start using "[Cd.3] Positioning start No." with the pre-reading start function are No. 1 to 600 only. Performing the pre-reading start function at the setting of No. 7000 to 7004 or 9001 to 9004 will result in the error "Outside start No. range" (error code: 19A3H).
- Always turn ON the execution prohibition flag at the same time or before turning ON the positioning start signal. Pre-reading may not be started if the execution prohibition flag is turned ON during Ta after the positioning start signal is turned ON. The pre-reading start function is invalid if the execution prohibition flag is turned ON after positioning start with the execution prohibition flag OFF. (It is made valid at the next positioning start.)

## Program example

Refer to the following for the program example.

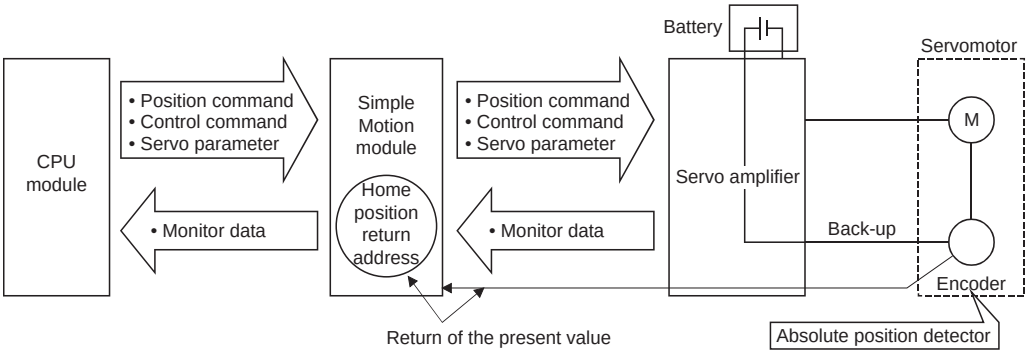



| Classification | Label name | Description |
|---|---|---|
| Module label | RD77_1.bnBusy[0] | Axis 1 BUSY |
| | RD77_1.bnPositioningStart[0] | Axis 1 Positioning start |
| | RD77_1.stnAxMntr[0].uStatus.D | Axis 1 Error detection |
| | RD77_1.stnAxMntr[0].uStatus.E | Axis 1 Start complete |
| | RD77_1.stnAxCtrl1_D[0].uPositioningStartNo_D | Axis 1 Positioning start No. |
| | RD77_1.stnAxCtrl2_D[0].uProhibitPositioning_D.0 | Axis 1 Execution prohibition flag |
| | RD77_1.stnAxCtrl2_D[0].uProhibitPositioning_D | |
| Global label, local label | Defines the global label or the local label as follows. The settings of Assign (Device/Label) are not required for the label that the assignment device is not set because the unused internal relay and data device are automatically assigned. | |

| | Label Name | Data Type | | Class |
|---|---|---|---|---|
| 1 | bPreReadingStartReq_P | Bit | ... | VAR |
| 2 | bInputPreReadingStartReq | Bit | ... | VAR |
| 3 | bInputExecutionProhibitionFlagRe | Bit | ... | VAR |
| 4 | | | ... | |

# 8.7 Absolute Position System

The Simple Motion module can construct an absolute position system by installing the absolute position system and connecting it through SSCNETⅢ/H.
The following describes precautions when constructing the absolute position system.
The configuration of the absolute position system is shown below.




## Setting for absolute positions

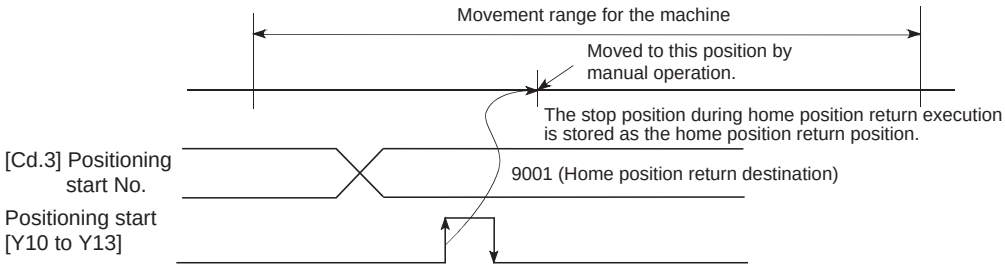
For constructing an absolute position system, use a servo amplifier and a servomotor which enable absolute position detection.
It is also necessary to install a battery for retaining the location of the home position return in the servo amplifier.
To use the absolute position system, select "1: Enabled (absolute position detection system)" in "Absolute position detection system (PA03)" in the amplifier setting for the servo parameters (basic setting). Refer to each servo amplifier instruction manual for details of the absolute position system.
n: Axis No. - 1

| Item | Buffer memory address |
|---|---|
| Absolute position detection system (PA03) | 28403+100n |

## Home position return

The absolute position system can establish the home position using home position return methods as follows: "Data set method", "Near-point dog method", "Count method" and "Scale origin signal detection method".
In the "Data set method" home position return method, the location to which the location of the home position is moved by manual operation (JOG operation/manual pulse generator operation) is treated as the home position.

### ■RD77MS4 operation example


Movement range for the machine
Moved to this position by manual operation.
The stop position during home position return execution is stored as the home position return position.
[Cd.3] Positioning start No.
9001 (Home position return destination)
Positioning start [Y10 to Y13]

# 8.8 Functions Related to Stop

Functions related to stop include the "stop command processing for deceleration stop function", "Continuous operation interrupt function" and "step function". Each function is executed by parameter setting or program creation and writing.

## Stop command processing for deceleration stop function

The "stop command processing for deceleration stop function" is provided to set the deceleration curve if a stop cause occurs during deceleration stop processing (including automatic deceleration).

This function is valid for both trapezoidal and S-curve acceleration/deceleration processing methods.

Refer to the following for details of the stop cause.

☞ Page 25 Stop process

The "stop command processing for deceleration stop function" performs the following two operations.

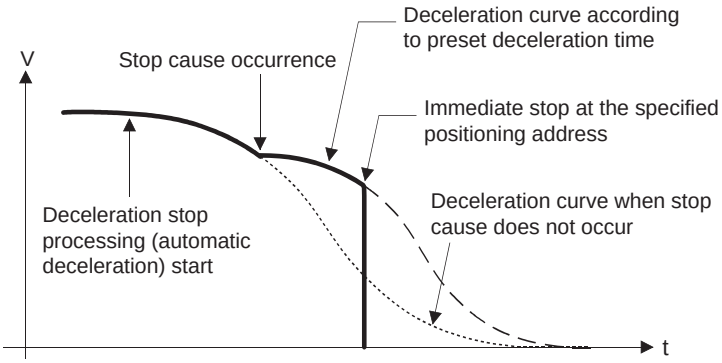
### Control

The operation of "stop command processing for deceleration stop function" is explained below.

#### ■Deceleration curve re-processing

A deceleration curve is re-processed starting from the speed at stop cause occurrence until at a stop, according to the preset deceleration time.

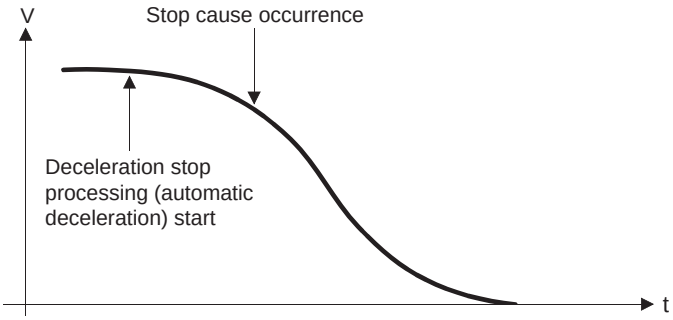
If a stop cause occurs during automatic deceleration of position control, the deceleration stop processing stops as soon as the target has reached the positioning address specified in the positioning data that is currently executed.


V
Stop cause occurrence
Deceleration curve according to preset deceleration time
Immediate stop at the specified positioning address
Deceleration curve when stop cause does not occur
Deceleration stop processing (automatic deceleration) start
t

#### ■Deceleration curve continuation

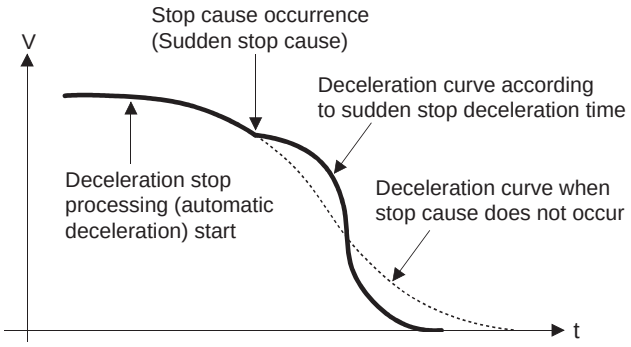
The current deceleration curve is continued after a stop cause has occurred.

If a stop cause occurs during automatic deceleration of position control, the deceleration stop processing may be complete before the target has reached the positioning address specified in the positioning data that is currently executed.

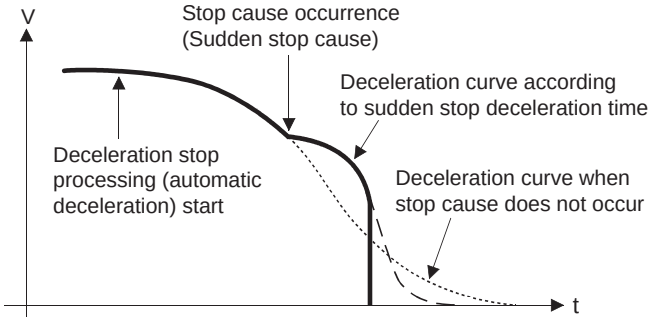


## Precautions for control

- In manual control (JOG operation, inching operation, manual pulse generator operation) and speed-torque control, the stop command processing for deceleration stop function is invalid.
- The stop command processing for deceleration stop function is valid when "0: Normal deceleration stop" is set in "[Pr.37] Stop group 1 sudden stop selection" to "[Pr.39] Stop group 3 sudden stop selection" as the stopping method for stop cause occurrence.
- The stop command processing for deceleration stop function is invalid when "1: Sudden stop" is set in "[Pr.37] Stop group 1 sudden stop selection" to "[Pr.39] Stop group 3 sudden stop selection". (A deceleration curve is re-processed starting from the speed at stop cause occurrence until at a stop, according to the "[Pr.36] Sudden stop deceleration time".) In the position control (including position control of speed/position changeover control or position/speed changeover control) mode, positioning may stop immediately depending on the stop cause occurrence timing and "[Pr.36] Sudden stop deceleration time" setting.




(Sudden stop in front of the specified positioning address)




(Immediate stop at the specified positioning address)

## Setting method

To use the "stop command processing for deceleration stop function", set the following control data in a program.
The set data are made valid as soon as they are written to the buffer memory. The PLC ready signal [Y0] is irrelevant.

| Setting item | | Setting value | Setting details | Buffer memory address |
|---|---|---|---|---|
| [Cd.42] | Stop command processing for deceleration stop selection | → | Set the stop command processing for deceleration stop function.<br>0: Deceleration curve re-processing<br>1: Deceleration curve continuation | 5907 |

Refer to the following for the setting details.

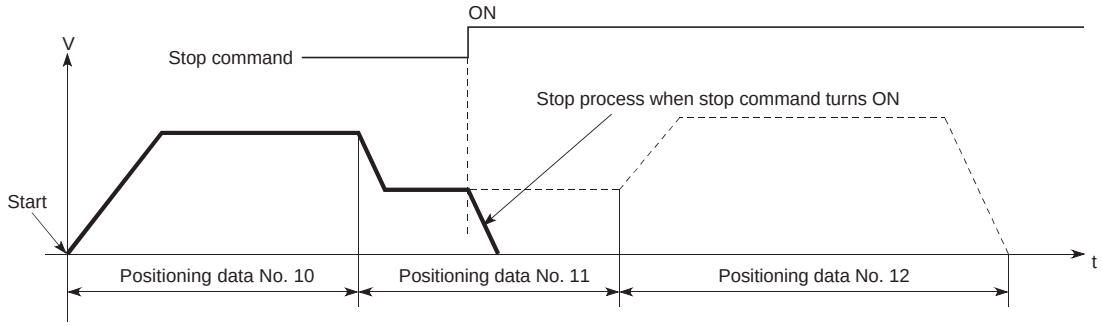
☞ Page 504 Control Data

# Continuous operation interrupt function

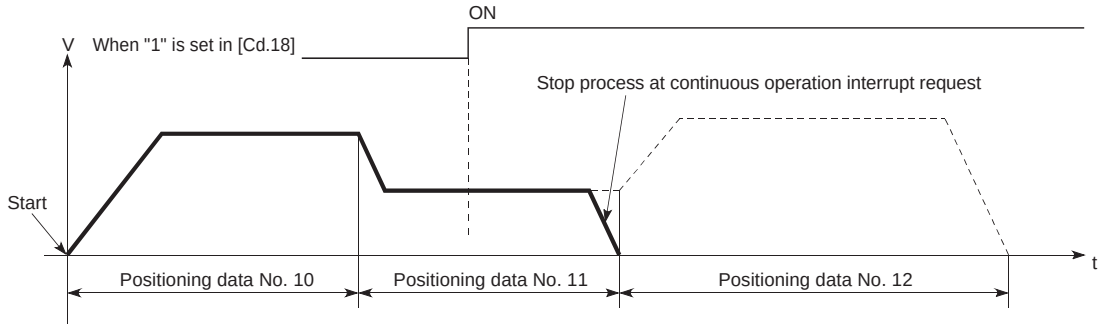
During positioning control, the control can be interrupted during continuous positioning control and continuous path control (continuous operation interrupt function). When "continuous operation interruption" is execution, the control will stop when the operation of the positioning data being executed ends. To execute continuous operation interruption, set "1: Continuous operation interrupt request" for "[Cd.18] Interrupt request during continuous operation".

## Operation during continuous operation interruption

When the stop command is ON

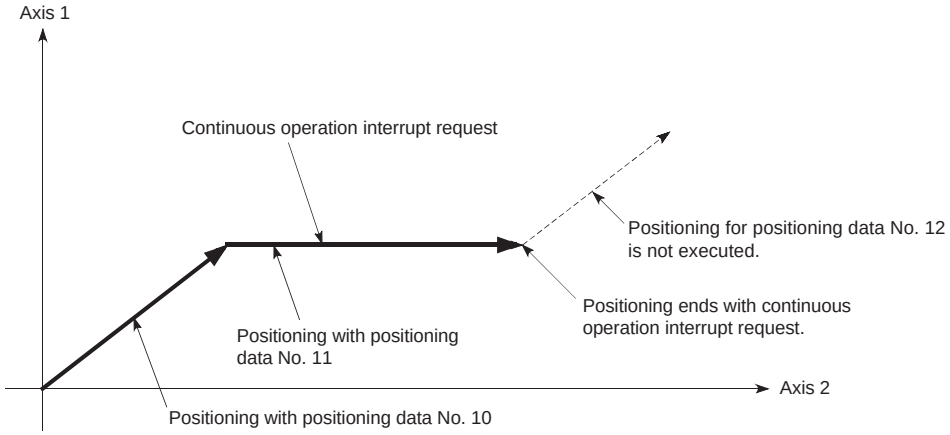



When "1" is set in [Cd.18]



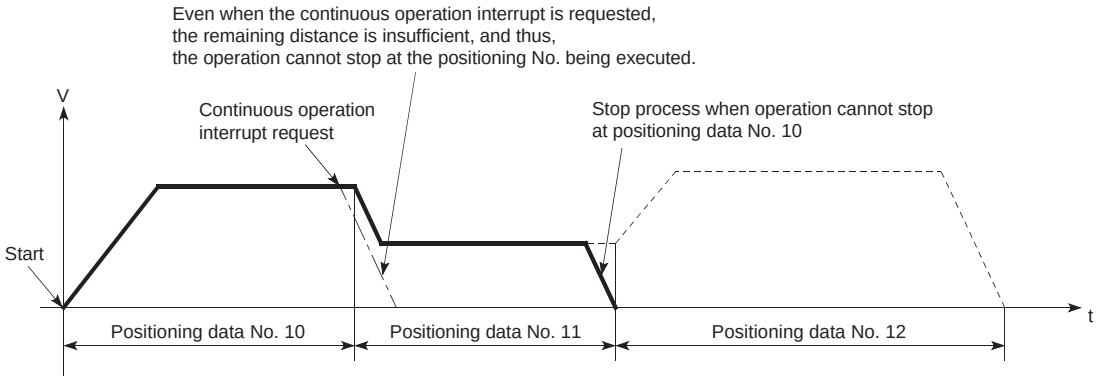
## Restrictions

- When the "continuous operation interrupt request" is executed, the positioning will end. Thus, after stopping, the operation cannot be "restarted". When "[Cd.6] Restart command" is issued, the warning "Restart not possible" (warning code: 0902H) will occur.
- Even if the stop command is turned ON after executing the "continuous operation interrupt request", the "continuous operation interrupt request" cannot be canceled. Thus, if "restart" is executed after stopping by turning the stop command ON, the operation will stop when the positioning data No. where "continuous operation interrupt request" was executed is completed.




- If the operation cannot be decelerated to a stop because the remaining distance is insufficient when "continuous operation interrupt request" is executed with continuous path control, the interruption of the continuous operation will be postponed until the positioning data shown below.

- Positioning data No. have sufficient remaining distance
- Positioning data No. for positioning complete (pattern: 00)
- Positioning data No. for continuous positioning control (pattern: 01)


Even when the continuous operation interrupt is requested,
the remaining distance is insufficient, and thus,
the operation cannot stop at the positioning No. being executed.
V
Continuous operation
interrupt request
Stop process when operation cannot stop
at positioning data No. 10
Start
t
Positioning data No. 10
Positioning data No. 11
Positioning data No. 12

- When operation is not performed (BUSY signal is OFF), the interrupt request during continuous operation is not accepted. It is cleared to 0 at a start or restart.

## Control data requiring settings

Set the following data to interrupt continuous operation.

n: Axis No. - 1

| Setting item | | Setting value | Setting details | Buffer memory address |
|---|---|---|---|---|
| [Cd.18] | Interrupt request during continuous operation | 1 | Set "1: Interrupt request during continuous operation". | 4320+100n |

Refer to the following for the setting details.

☞ Page 504 Control Data

# Step function

The "step function" is used to confirm each operation of the positioning control one by one.
It is used in debugging work for major positioning control, etc.
A positioning operation in which a "step function" is used is called a "step operation".
In step operations, the timing for stopping the control can be set. (This is called the "step mode".) Control stopped by a step operation can be continued by setting "step continues (to continue the control)" in the "step start information".

## Relation between the step function and various controls

The following table shows the relation between the "step function" and various controls.
○: Set when required, ×: Setting not possible

| Control type | | | Step function | Step applicability |
|---|---|---|---|---|
| Home position return control | Machine home position return control | | × | Step operation not possible |
| | Fast home position return control | | × | |
| Major positioning control | Position control | 1-axis linear control | ○ | Step operation possible |
| | | 2 to 4-axis linear interpolation control | ○ | |
| | | 1-axis fixed-feed control | ○ | |
| | | 2 to 4-axis fixed-feed control (interpolation) | ○ | |
| | | 2-axis circular interpolation control | ○ | |
| | | 3-axis helical interpolation control | ○ | |
| | 1 to 4-axis speed control | | × | Step operation not possible |
| | Speed-position switching control, Position-speed switching control | | ○ | Step operation possible |
| | Other control | Current value changing | ○ | |
| | | JUMP instruction, NOP instruction, LOOP to LEND | × | Step operation not possible |
| Manual control | JOG operation, Inching operation | | × | Step operation not possible |
| | Manual pulse generator operation | | × | |
| Expansion control | Speed-torque control | | × | |

## Step mode

In step operations, the timing for stopping the control can be set. This is called the "step mode". (The "step mode" is set in the control data "[Cd.34] Step mode".)
The following shows the two types of "step mode" functions.

### ■Deceleration unit step

The operation stops at positioning data requiring automatic deceleration. (A normal operation will be carried out until the positioning data requiring automatic deceleration is found. Once found, that positioning data will be executed, and the operation will then automatically decelerate and stop.)

### ■Data No. unit step

The operation automatically decelerates and stops for each positioning data. (Even in continuous path control, an automatic deceleration and stop will be forcibly carried out.)

## Step start request

Control stopped by a step operation can be continued by setting "step continues" (to continue the control) in the "step start information". (The "step start information" is set in the control data "[Cd.36] Step start information".)
The following table shows the results of starts using the "step start information" during step operation.

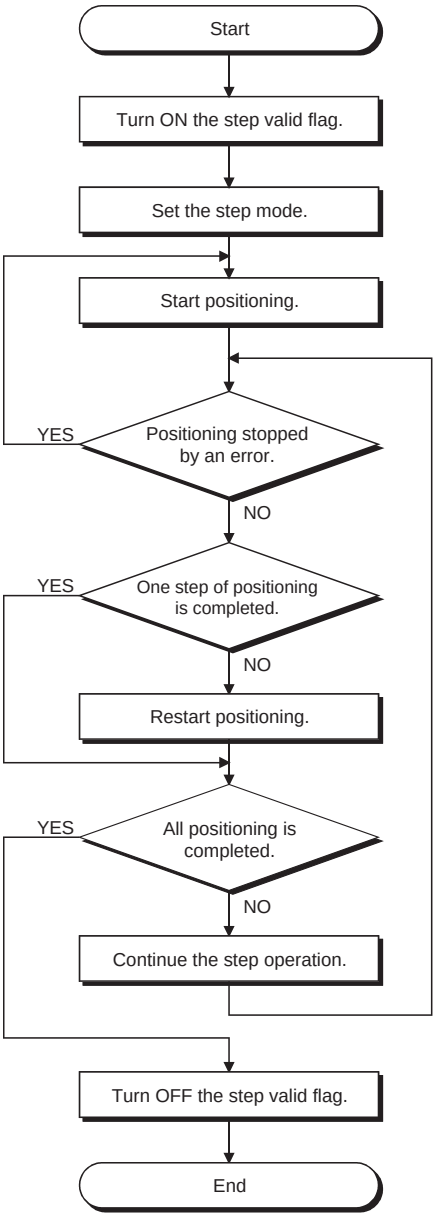
| Stop status in the step operation | [Md.26] Axis operation status | [Cd.36] Step start information | Step start results |
|---|---|---|---|
| 1 step of positioning stopped normally | Step standby | 1: Continues step operation | The next positioning data is executed. |

The warning "Step not possible" (warning code: 0996H) will occur if the "[Md.26] Axis operation status" is as shown below or the step valid flag is OFF when step start information is set.

| [Md.26] Axis operation status | Step start results |
|---|---|
| Standby | Step not continued by warning |
| Stopped | |
| Interpolation | |
| JOG operation | |
| Manual pulse generator operation | |
| Analyzing | |
| Special start standby | |
| Home position return | |
| Position control | |
| Speed control | |
| Speed control in speed-position switching control | |
| Position control in speed-position switching control | |
| Speed control in position-speed switching control | |
| Position control in position-speed switching control | |
| Synchronous control | |
| Control mode switch | |
| Speed control | |
| Torque control | |
| Continuous operation to torque control | |

## Using the step operation

The following shows the procedure for checking positioning data using the step operation.




Write "1" (carry out step operation) in "[Cd.35] Step valid flag".

Set in "[Cd.34] Step mode".

Write "1" (restart) to "[Cd.6] Restart command" and check whether the positioning data operates normally.

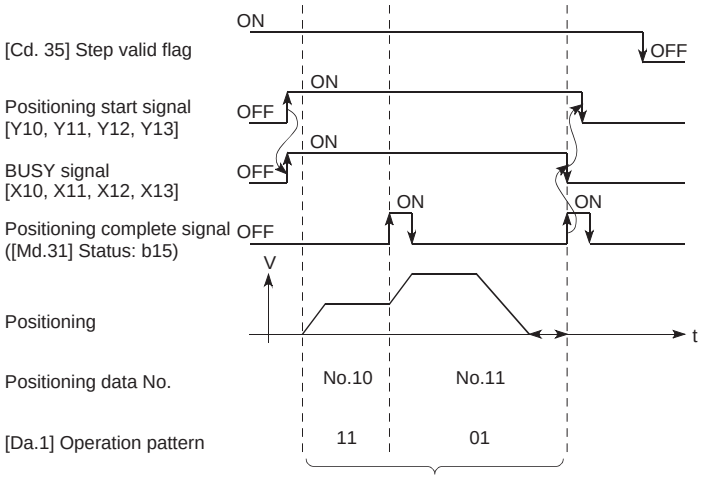
Write "1" (step continue) in "[Cd.36] Step start information", and check whether the next positioning data operates normally.

Write "0" (carry out no step operation) in "[Cd.35] Step valid flag".

## Control details

- The following drawing shows a step operation during a "deceleration unit step".

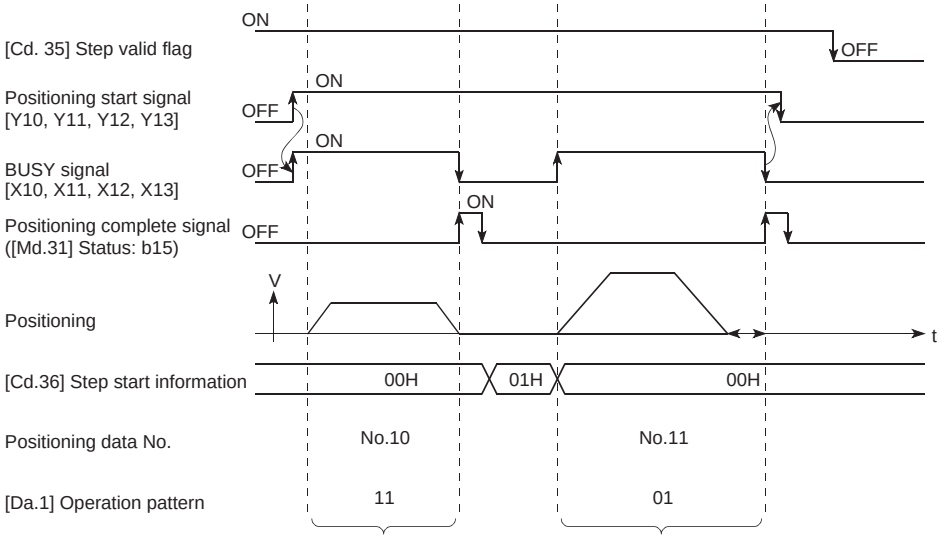
### ■RD77MS4 operation example




No positioning data No. unit, so operation pattern becomes one step of unit for carrying out automatic deceleration.

- The following drawing shows a step operation during a "data No. unit step".

### ■RD77MS4 operation example




Operation pattern becomes one step of positioning data No. unit, regardless of continuous path control (11).

## Precautions during control

- When step operation is carried out using interpolation control positioning data, the step function settings are carried out for the reference axis.
- When the step valid flag is ON, the step operation will start from the beginning if the positioning start signal is turned ON while "[Md.26] Axis operation status" is "step standby". (The step operation will be carried out from the positioning data set in "[Cd.3] Positioning start No.".)

## Step function settings

To use the "step function", write the data shown in the following table to the Simple Motion module using the program. Refer to the following for the timing of the settings.

☞ Page 275 Using the step operation

The set details are validated after they are written to the Simple Motion module.

n: Axis No. - 1

| Setting item | | Setting value | Setting details | Buffer memory address |
|---|---|---|---|---|
| [Cd.34] | Step mode | → | Set "0: Stepping by deceleration units" or "1: Stepping by data No. units". | 4344+100n |
| [Cd.35] | Step valid flag | 1 | Set "1: Validates step operations". | 4345+100n |
| [Cd.36] | Step start information | → | Set "1: Continues step operation", depending on the stop status. | 4346+100n |

Refer to the following for the setting details.

☞ Page 504 Control Data

# 8.9 Other Functions

Other functions include the "skip function", "M code output function", "teaching function", "command in-position function", "acceleration/deceleration processing function", "deceleration start flag function", "speed control 10 × multiplier setting for degree axis function" and "operation setting for incompletion of home position return function".
Each function is executed by parameter setting or program creation and writing.

## Skip function

The "skip function" is used to stop (deceleration stop) the control of the positioning data being executed at the time of the skip signal input, and execute the next positioning data.
A skip is executed by a skip command ([Cd.37] Skip command) or external command signal.
The "skip function" can be used during control in which positioning data is used.

### Relation between the skip function and various controls

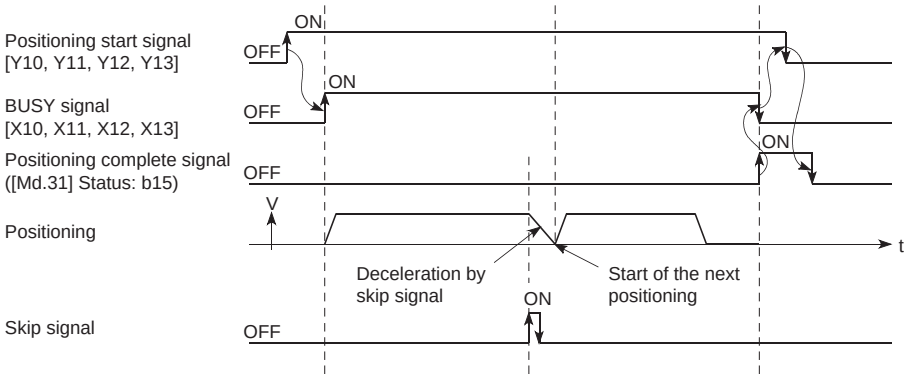
The following table shows the relation between the "skip function" and various controls.
○: Set when required, ×: Setting not possible

| Control type | | | Skip function | Skip applicability |
|---|---|---|---|---|
| Home position return control | Machine home position return control | | × | Skip operation not possible |
| | Fast home position return control | | × | |
| Major positioning control | Position control | 1-axis linear control | ○ | Skip operation possible |
| | | 2 to 4-axis linear interpolation control | ○ | |
| | | 1-axis fixed-feed control | ○ | |
| | | 2 to 4-axis fixed-feed control (interpolation) | ○ | |
| | | 2-axis circular interpolation control | ○ | |
| | | 3-axis helical interpolation control | ○ | |
| | 1 to 4-axis speed control | | × | Skip operation not possible |
| | Speed-position switching control | | ○ | Skip operation possible |
| | Position-speed switching control | | × | Skip operation not possible |
| | Other control | Current value changing | ○ | Skip operation possible |
| | | JUMP instruction, NOP instruction, LOOP to LEND | × | Skip operation not possible |
| Manual control | JOG operation, Inching operation | | × | Skip operation not possible |
| | Manual pulse generator operation | | × | |
| Expansion control | Speed-torque control | | × | |

### Control details

The following drawing shows the skip function operation.

#### ■RD77MS4 operation example



## Precautions during control

- If the skip signal is turned ON at the last of an operation, a deceleration stop will occur and the operation will be terminated.
- When a control is skipped (when the skip signal is turned ON during a control), the positioning complete signals will not turn ON.
- When the skip signal is turned ON during the dwell time, the remaining dwell time will be ignored, and the next positioning data will be executed.
- When a control is skipped during interpolation control, the reference axis skip signal is turned ON. When the reference axis skip signal is turned ON, a deceleration stop will be carried out for every axis, and the next reference axis positioning data will be executed.
- The M code ON signals will not turn ON when the M code output is set to the AFTER mode. (In this case, the M code will not be stored in "[Md.25] Valid M code".)
- The skip cannot be carried out by the speed control and position-speed switching control.
- If the skip signal is turned ON with the M code signal turned ON, the transition to the next data is not carried out until the M code signal is turned OFF.

## Setting method from the CPU module

The following shows the settings and program example for skipping the control being executed in axis 1 with a command from the CPU module.

### ■Setting data

Set the following data.

n: Axis No. - 1

| Setting item | | Setting value | Setting details | Buffer memory address |
|---|---|---|---|---|
| [Cd.37] | Skip command | 1 | Set "1: Skip request". | 4347+100n |

Refer to the following for the setting details.

☞ Page 504 Control Data

- Add the following program to the control program, and write it to the CPU module.

When the "skip command" is input, the value "1" (skip request) set in "[Cd.37] Skip command" is written to the buffer memory of the Simple Motion module.

### ■Program

Refer to the following for the program example.

☞ Page 570 Skip program

## Setting method using an external command signal

The skip function can also be executed using an "external command signal".

The following shows the settings and program example for skipping the control being executed in axis 1 using an "external command signal".

- Set the following data to execute the skip function using an external command signal. (The setting is carried out using the program.)

n: Axis No. - 1

| Setting item | | Setting value | Setting details | Buffer memory address |
|---|---|---|---|---|
| [Pr.42] | External command function selection | 3 | Set "3: Skip request". | 62+150n |
| [Cd.8] | External command valid | 1 | Set "1: Validate external command". | 4305+100n |

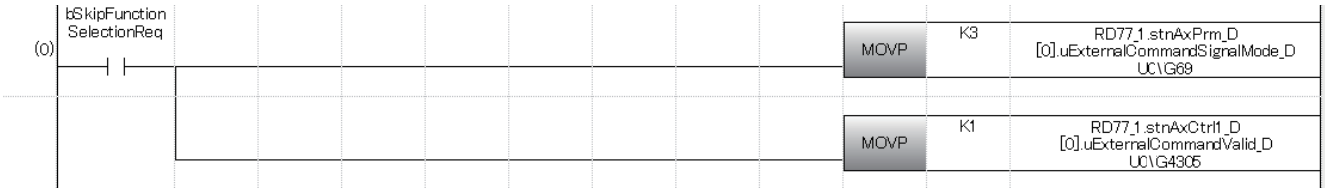
Refer to the followings for the setting details.

☞ Page 407 Basic Setting, Page 504 Control Data

- Add the following program to the control program, and write it to the CPU module.

### ■Program

Refer to the following for the program example.




| Classification | Label name | Description |
|---|---|---|
| Module label | RD77_1.stnAxPrm_D[0].uExternalCommandSignalMode_D | Axis 1 External command signal selection |
| | RD77_1.stnAxCtrl1_D[0].uExternalCommandValid_D | Axis 1 External command valid |
| Global label, local label | Defines the global label or the local label as follows. The settings of Assign (Device/Label) are not required for the label that the assignment device is not set because the unused internal relay and data device are automatically assigned. | |

| | Label Name | Data Type | | Class |
|---|---|---|---|---|
| 1 | bSkipFunctionSelectionReq | Bit | ... | VAR |
| 2 | | | ... | |

# M code output function

The "M code output function" is used to command sub work (clamping, drill rotation, tool replacement, etc.) related to the positioning data being executed.
When the M code ON signal ([Md.31] Status: b12) is turned ON during positioning execution, a No. called the M code is stored in "[Md.25] Valid M code".
These "[Md.25] Valid M code" are read from the CPU module, and used to command auxiliary work. M codes can be set for each positioning data. (Set in setting item "[Da.10] M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches" of the positioning data.)
The timing for outputting (storing) the M codes can also be set in the "M code output function".

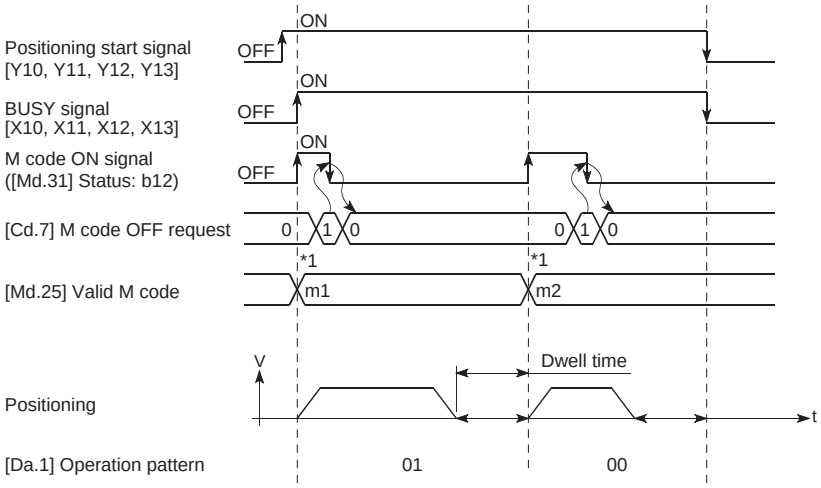
## M code ON signal output timing

The timing for outputting (storing) the M codes can be set in the "M code output function". (The M code is stored in "[Md.25] Valid M code" when the M code ON signal is turned ON.)
The following shows the two types of timing for outputting M codes: the "WITH mode" and the "AFTER mode".

### ■WITH mode

The M code ON signal is turned ON at the positioning start, and the M code is stored in "[Md.25] Valid M code".

### ■RD77MS4 operation example

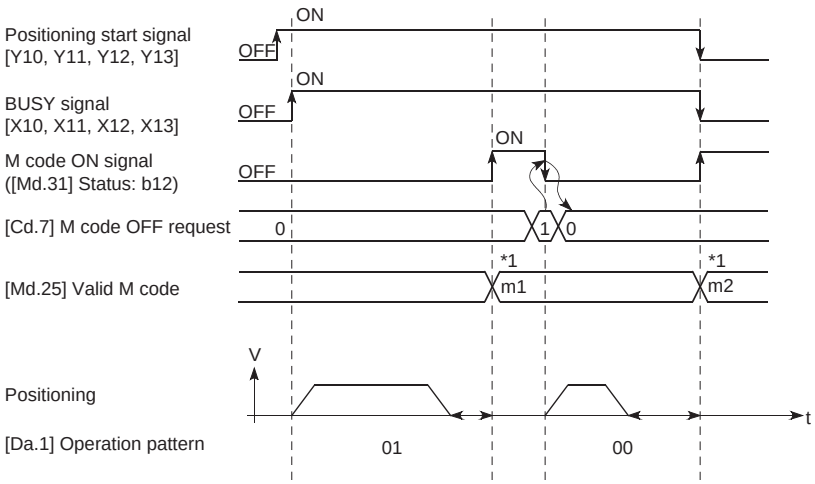



*1 m1 and m2 indicate set M codes.

### ■AFTER mode

The M code ON signal is turned ON at the positioning completion, and the M code is stored in "[Md.25] Valid M code".

### ■RD77MS4 operation example




*1 m1 and m2 indicate set M codes.

## M code ON signal OFF request

When the M code ON signal is ON, it must be turned OFF by the program.

To turn OFF the M code ON signal, set "1" (turn OFF the M code signal) in "[Cd.7] M code OFF request".

n: Axis No. - 1

| Setting item | | Setting value | Setting details | Buffer memory address |
|---|---|---|---|---|
| [Cd.7] | M code OFF request | 1 | Set "1: Turn OFF the M code ON signal". | 4304+100n |

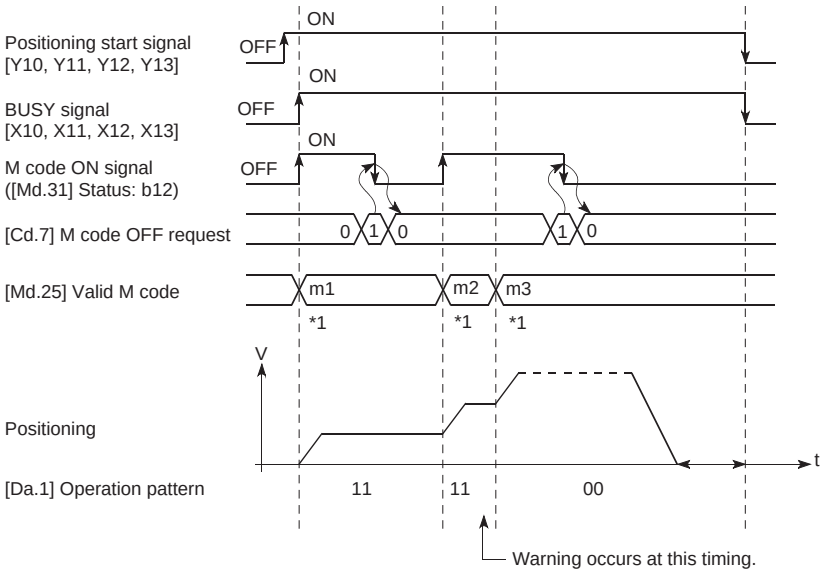
Refer to the following for the setting details.

☞ Page 504 Control Data

The next positioning data will be processed as follows if the M code ON signal is not turned OFF. (The processing differs according to the "[Da.1] Operation pattern".)

| [Da.1] Operation pattern | | Processing |
|---|---|---|
| 00 | Independent positioning control (Positioning control) | The next positioning data will not be executed until the M code ON signal is turned OFF. |
| 01 | Continuous positioning control | |
| 11 | Continuous path control | The next positioning data will be executed. If the M code is set to the next positioning data, the warning "M code ON signal ON" (warning code: 0992H) will occur. |

### ■RD77MS4 operation example




*1 m1 and m3 indicate set M codes.

**Point**

If the M code output function is not required, set "0" in the setting item of the positioning data "[Da.10] M code/ Condition data No./Number of LOOP to LEND repetitions/Number of pitches".

## Precautions during control

- During interpolation control, the reference axis M code ON signal is turned ON.
- The M code ON signal will not turn ON if "0" is set in "[Da.10] M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches". (The M code will not be output, and the previously output value will be held in "[Md.25] Valid M code".)
- If the M code ON signal is ON at the positioning start, the error "M code ON signal start" (error code: 19A0H) will occur, and the positioning will not start.
- If the PLC READY signal [Y0] is turned OFF, the M code ON signal will turn OFF and "0" will be stored in "[Md.25] Valid M code".
- If the positioning operation time is short during continuous path control, there will not be enough time to turn OFF the M code ON signal and the warning "M code ON signal ON" (warning code: 0992H) may occur. In this case, set a "0" in the "[Da.10] M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches" of that section's positioning data to prevent the M code from being output for avoiding the warning occurrence.
- In the AFTER mode during speed control, the M code is not output and the M code ON signal does not turn ON.
- If current value changing where "9003" has been set to "[Cd.3] Positioning start No." is performed, the M code output function is made invalid.

## Setting method

The following shows the settings to use the "M code output function".

- Set the M code No. in the positioning data "[Da.10] M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches".
- Set the timing to output the M code ON signal. The "WITH mode/AFTER mode" also can be set for each positioning data.

Set the required value in the following parameter, and write it to the Simple Motion module. The set details are validated at the rising edge (OFF → ON) of the PLC READY signal [Y0].

n: Axis No. - 1

| Setting item | | Setting value | Setting details | Buffer memory address |
|---|---|---|---|---|
| [Pr.18] | M code ON signal output timing | → | Set the timing to output the M code ON signal.<br>0: WITH mode<br>1: AFTER mode | 27+150n |

Refer to the following for the setting details.

☞ Page 407 Basic Setting

## Reading M codes

"M codes" are stored in the following buffer memory when the M code ON signal turns ON.

n: Axis No. - 1

| Monitor item | | Monitor value | Storage details | Buffer memory address |
|---|---|---|---|---|
| [Md.25] | Valid M code | → | The M code No. ([Da.10] M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches) set in the positioning data is stored. | 2408+100n |

Refer to the following for information on the storage details.

☞ Page 468 Monitor Data

The following shows a program example for reading the "[Md.25] Valid M code" to the data register (D110) of the CPU module. (The read value is used to command the sub work.)

Read M codes not as "rising edge commands", but as "ON execution commands".

### ■Program example

Refer to the following for the program example.

| Classification | Label name | Description |
|---|---|---|
| Module label | RD77_1.stnAxMntr[0].uStatus.C | Axis 1 M code ON |
| | RD77_1.stnAxMntr[0].uM_Code | Axis 1 Valid M code |
| Global label, local label | Defines the global label or the local label as follows. The settings of Assign (Device/Label) are not required for the label that the assignment device is not set because the unused internal relay and data device are automatically assigned. | |

| | Label Name | Data Type | | Class |
|---|---|---|---|---|
| 1 | uValidMcode | Word [Signed] | ... | VAR |
| 2 | | | ... | |

# Teaching function

The "teaching function" is used to set addresses aligned using the manual control (JOG operation, inching operation manual pulse generator operation) in the positioning data addresses ("[Da.6] Positioning address/movement amount", "[Da.7] Arc address").

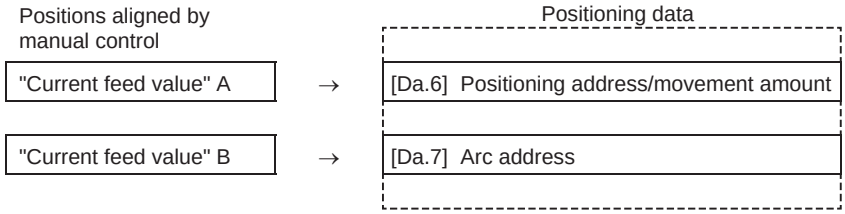
## Control details

### ■Teaching timing

Teaching is executed using the program when the BUSY signal [X10 to X1F] is OFF. (During manual control, teaching can be carried out as long as the axis is not BUSY, even when an error or warning has occurred.)

### ■Addresses for which teaching is possible

The addresses for which teaching is possible are "current feed values" ([Md.20] Current feed value) having the home position as a reference. The settings of the "movement amount" used in incremental system positioning cannot be used. In the teaching function, these "current feed values" are set in the "[Da.6] Positioning address/movement amount" or "[Da.7] Arc address".




## Precautions during control

- Before teaching, a "machine home position return" must be carried out to establish the home position. (When a current value changing, etc., is carried out, "[Md.20] Current feed value" may not show absolute addresses having the home position as a reference.)
- Teaching cannot be carried out for positions to which movement cannot be executed by manual control (positions to which the workpiece cannot physically move). (During center point designation circular interpolation control, etc., teaching of "[Da.7] Arc address" cannot be carried out if the center point of the arc is not within the moveable range of the workpiece.)
- Writing to the flash ROM can be executed up to 100,000 times. If writing to the flash ROM exceeds 100,000 times, the writing may become impossible (assured value is up to 100,000 times). If the error "Flash ROM write number error" (error code: 1080H) occurs when writing to the flash ROM has been completed, check whether or not the program is created so as to write continuously to the flash ROM.

## Data used in teaching

The following control data is used in teaching.

n: Axis No. - 1

| Setting item | | Setting value | Setting details | Buffer memory address |
|---|---|---|---|---|
| [Cd.1] | Flash ROM write request | 1 | Write the set details to the flash ROM (backup the changed data). | 5900 |
| [Cd.38] | Teaching data selection | → | Sets to which "current feed value" is written.<br>0: Written to "[Da.6] Positioning address/movement amount".<br>1: Written to "[Da.7] Arc address". | 4348+100n |
| [Cd.39] | Teaching positioning data No. | → | Designates the data to be taught.<br>(Teaching is carried out when the setting value is 1 to 600.)<br>When teaching has been completed, this data is zero cleared. | 4349+100n |

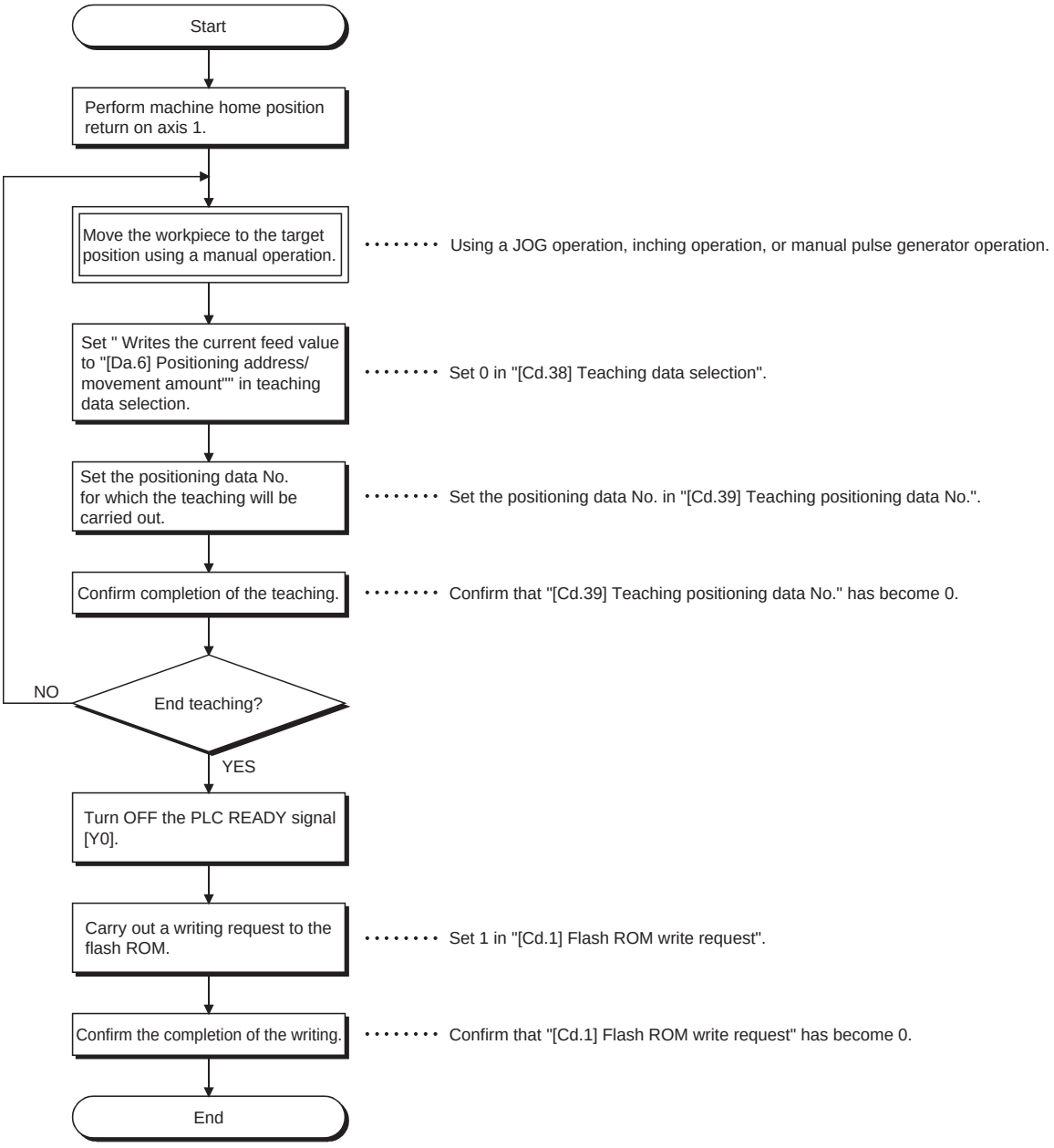
Refer to the following for the setting details.

☞ Page 504 Control Data

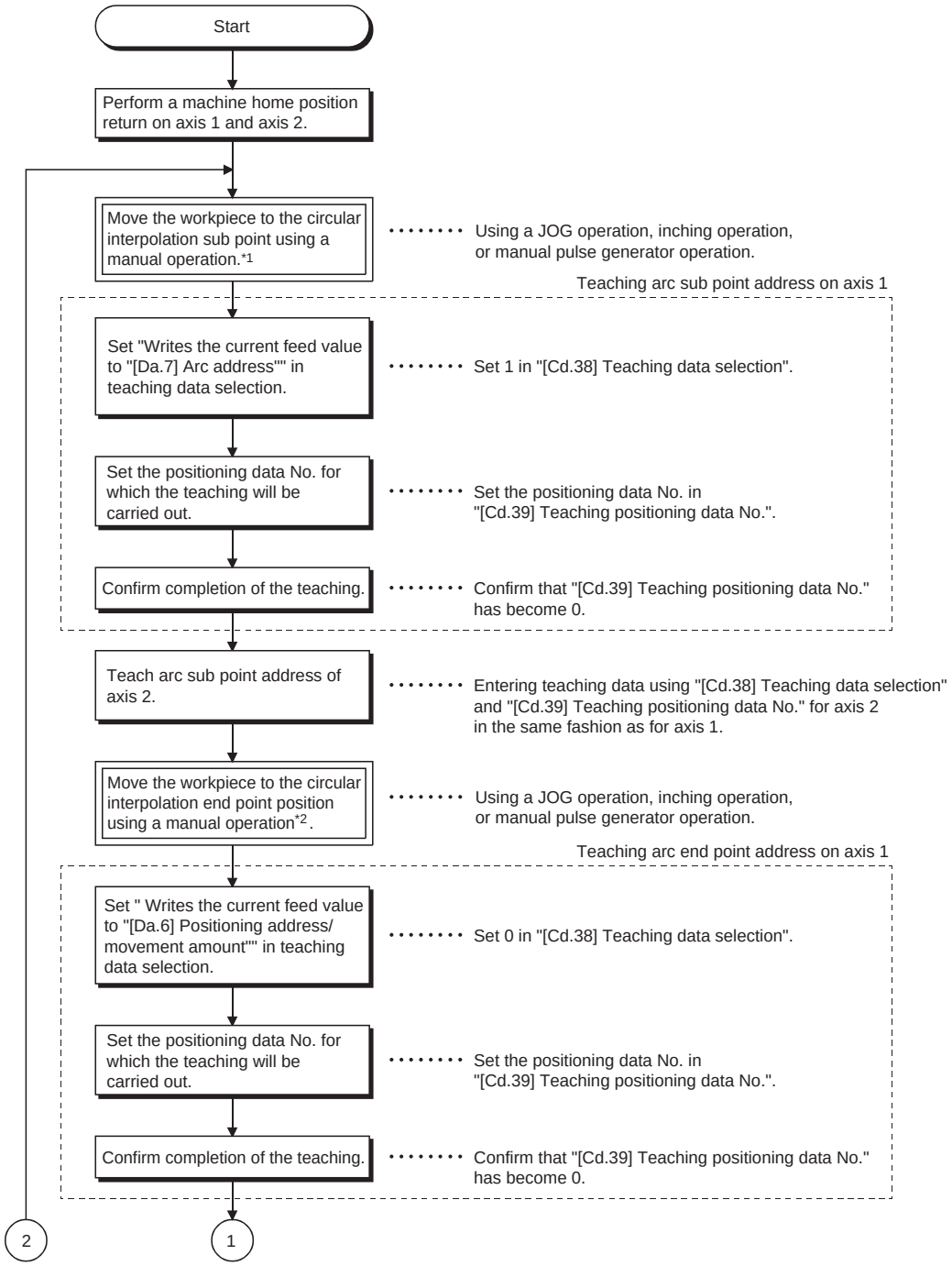
## Teaching procedure

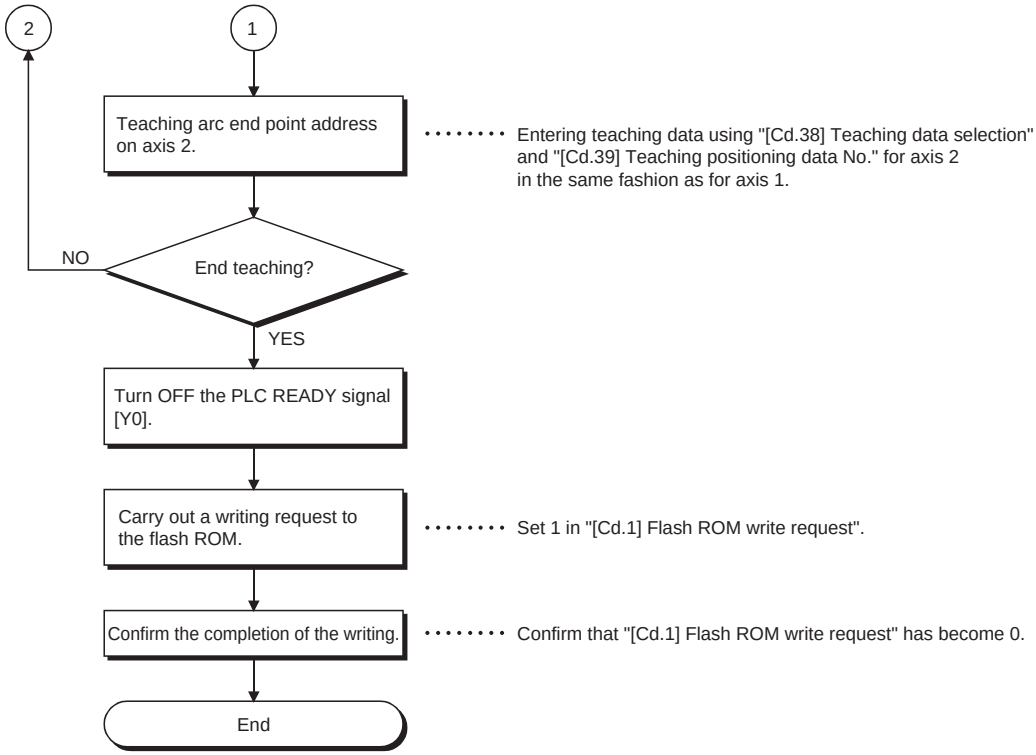
The following shows the procedure for a teaching operation.

- When teaching to the "[Da.6] Positioning address/movement amount" (Teaching example on axis 1)

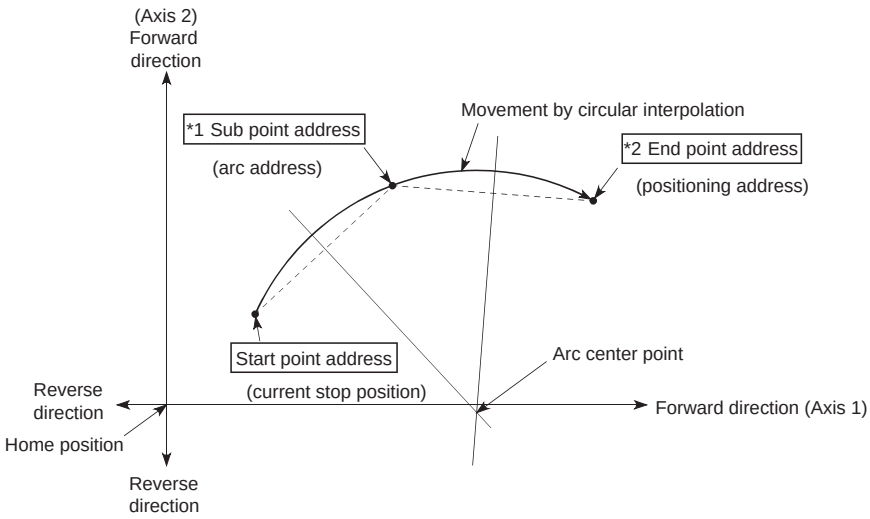

Start
Perform machine home position return on axis 1.
Move the workpiece to the target position using a manual operation.
Using a JOG operation, inching operation, or manual pulse generator operation.
Set " Writes the current feed value to "[Da.6] Positioning address/ movement amount"" in teaching data selection.
Set 0 in "[Cd.38] Teaching data selection".
Set the positioning data No. for which the teaching will be carried out.
Set the positioning data No. in "[Cd.39] Teaching positioning data No.".
Confirm completion of the teaching.
Confirm that "[Cd.39] Teaching positioning data No." has become 0.
End teaching?
NO
YES
Turn OFF the PLC READY signal [Y0].
Carry out a writing request to the flash ROM.
Set 1 in "[Cd.1] Flash ROM write request".
Confirm the completion of the writing.
Confirm that "[Cd.1] Flash ROM write request" has become 0.
End

- When teaching to the "[Da.7] Arc address", then teaching to the "[Da.6] Positioning address/movement amount" (Teaching example for 2-axis circular interpolation control with sub point designation on axis 1 and axis 2)


Start
Perform a machine home position return on axis 1 and axis 2.
Move the workpiece to the circular interpolation sub point using a manual operation.*1
Using a JOG operation, inching operation, or manual pulse generator operation.
Teaching arc sub point address on axis 1
Set "Writes the current feed value to "[Da.7] Arc address"" in teaching data selection.
Set 1 in "[Cd.38] Teaching data selection".
Set the positioning data No. for which the teaching will be carried out.
Set the positioning data No. in "[Cd.39] Teaching positioning data No.".
Confirm completion of the teaching.
Confirm that "[Cd.39] Teaching positioning data No." has become 0.
Teach arc sub point address of axis 2.
Entering teaching data using "[Cd.38] Teaching data selection" and "[Cd.39] Teaching positioning data No." for axis 2 in the same fashion as for axis 1.
Move the workpiece to the circular interpolation end point position using a manual operation*2.
Using a JOG operation, inching operation, or manual pulse generator operation.
Teaching arc end point address on axis 1
Set " Writes the current feed value to "[Da.6] Positioning address/ movement amount"" in teaching data selection.
Set 0 in "[Cd.38] Teaching data selection".
Set the positioning data No. for which the teaching will be carried out.
Set the positioning data No. in "[Cd.39] Teaching positioning data No.".
Confirm completion of the teaching.
Confirm that "[Cd.39] Teaching positioning data No." has become 0.
2
1


2
1
Teaching arc end point address on axis 2.
Entering teaching data using "[Cd.38] Teaching data selection" and "[Cd.39] Teaching positioning data No." for axis 2 in the same fashion as for axis 1.
NO
End teaching?
YES
Turn OFF the PLC READY signal [Y0].
Carry out a writing request to the flash ROM.
Set 1 in "[Cd.1] Flash ROM write request".
Confirm the completion of the writing.
Confirm that "[Cd.1] Flash ROM write request" has become 0.
End

## ■Motion path




*1 The sub point address is stored in the arc address.
*2 The end point address is stored in the positioning address.

## Teaching program example

The following shows a program example for setting (writing) the positioning data obtained with the teaching function to the Simple Motion module.

### ■Setting conditions

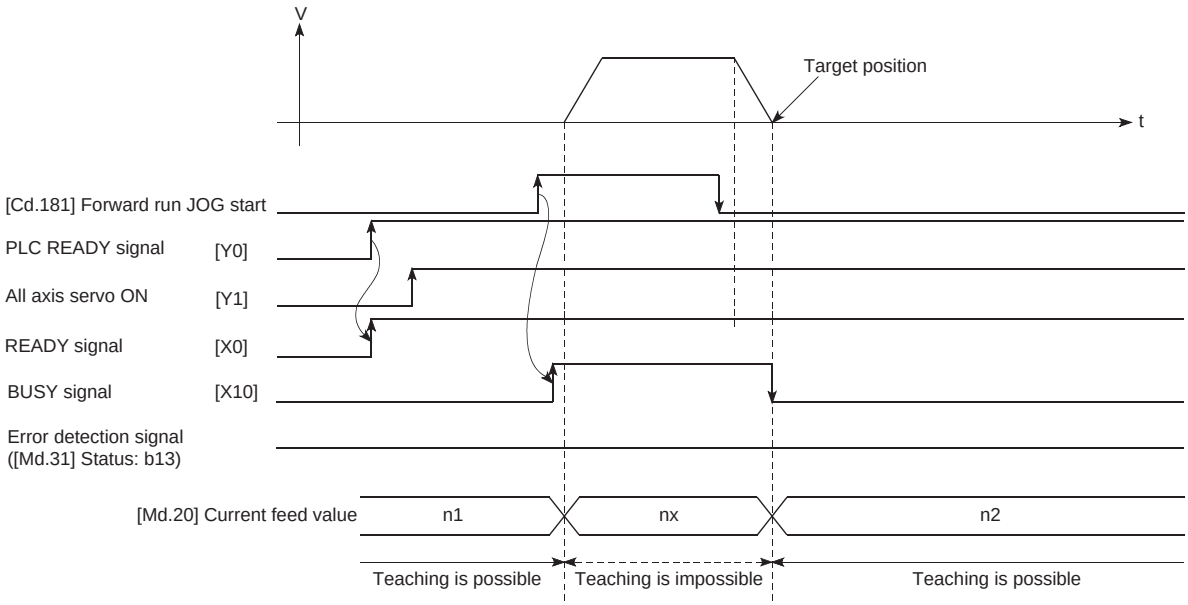
When setting the current feed value as the positioning address, write it when the BUSY signal is OFF.

### ■Program example

The following example shows a program to carry out the teaching of axis 1.

- Move the workpiece to the target position using a JOG operation (or an inching operation, a manual pulse generator operation).

### ■RD77MS4 operation example




Refer to the following for the program example.

☞ Page 570 Teaching program

**Point**

- Confirm the teaching function and teaching procedure before setting the positioning data.
- The positioning addresses that are written are absolute address (ABS) values.
- The positioning data written by the teaching function overwrites the data of buffer memory only. Therefore, read from buffer memory and write to flash ROM before turning the power OFF as necessary.

# Command in-position function

The "command in-position function" checks the remaining distance to the stop position during the automatic deceleration of positioning control, and sets "1". This flag is called the "command in-position flag". The command in-position flag is used as a front-loading signal indicating beforehand the completion of the position control.

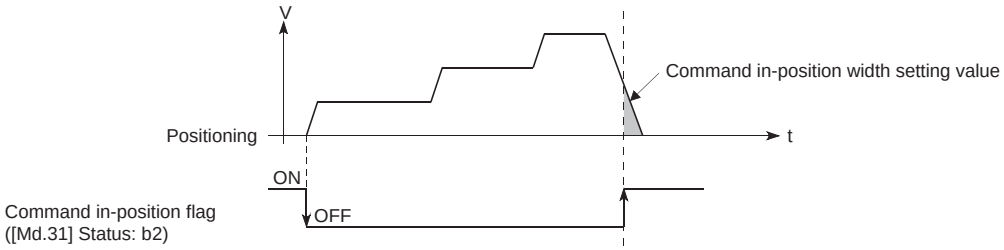
## Control details

The following shows control details of the command in-position function.

- When the remaining distance to the stop position during the automatic deceleration of positioning control becomes equal to or less than the value set in "[Pr.16] Command in-position width", "1" is stored in the command in-position flag ([Md.31] Status: b2).

### ■Command in-position width check

Remaining distance ≤ "[Pr.16] Command in-position width" setting value

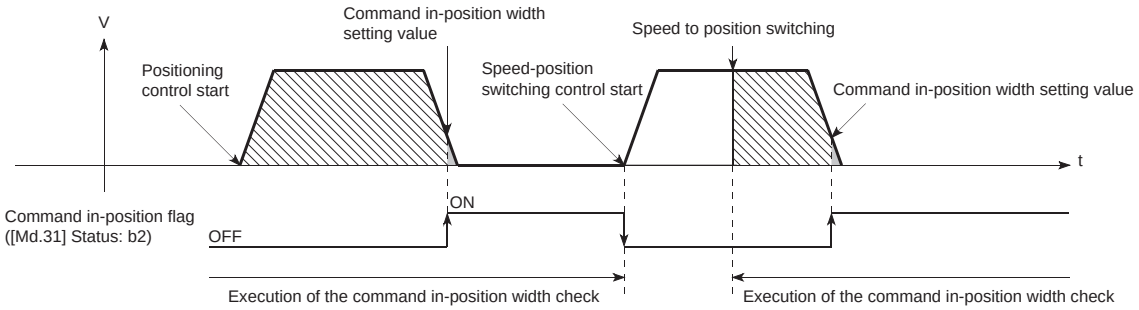



- A command in-position width check is carried out every operation cycle.

## Precautions during control

- A command in-position width check will not be carried out in the following cases.

  - During speed control
  - During speed control in speed-position switching control
  - During speed control in position-speed switching control
  - During speed control mode
  - During torque control mode
  - During continuous operation to torque control mode




- The command in-position flag will be turned OFF in the following cases. ("0" will be stored in "[Md.31] Status: b2".)

  - At the positioning control start
  - At the speed control start
  - At the speed-position switching control, position-speed switching control start
  - At the home position return control start
  - At the JOG operation start
  - At the inching operation start
  - When the manual pulse generator operation is enabled

- The "[Pr.16] Command in-position width" and command in-position flag ([Md.31] Status: b2) of the reference axis are used during interpolation control. When the "[Pr.20] Interpolation speed designation method" is "Composite speed", the command in-position width check is carried out in the remaining distance on the composite axis (line/arc connecting the start point address and end point address).

## Setting method

To use the "command in-position function", set the required value in the parameter shown in the following table, and write it to the Simple Motion module.

The set details are validated at the rising edge (OFF → ON) of the PLC READY signal [Y0].

| Setting item | | Setting value | Setting details | Factory-set initial value |
|---|---|---|---|---|
| [Pr.16] | Command in-position width | → | Turn ON the command in-position flag, and set the remaining distance to the stop position of the position control. | 100 |

Refer to the following for the setting details.

☞ Page 407 Basic Setting

## Confirming the command in-position flag

The "command in-position flag" is stored in the following buffer memory.

n: Axis No. - 1

| Monitor item | | Monitor value | Storage details | Buffer memory address |
|---|---|---|---|---|
| [Md.31] | Status | → | The command in-position flag is stored in the "b2" position. | 2417+100n |

Refer to the following for information on the storage details.

☞ Page 468 Monitor Data

**Point**

- Parameters are set for each axis.
- It is recommended that the parameters be set whenever possible with the engineering tool. Execution by a program uses many programs and devices. The execution becomes complicated, and the scan times will increase.

# Acceleration/deceleration processing function

The "acceleration/deceleration processing function" adjusts the acceleration/deceleration of each control to the acceleration/deceleration curve suitable for device.

Setting the acceleration/deceleration time changes the slope of the acceleration/deceleration curve.

The following two methods can be selected for the acceleration/deceleration curve:

- Trapezoidal acceleration/deceleration
- S-curve acceleration/deceleration

Refer to the following for acceleration/deceleration processing of speed-torque control.

☞ Page 193 Speed-torque Control

## "Acceleration/deceleration time 0 to 3" control details and setting

In the Simple Motion module, four types each of acceleration time and deceleration time can be set. By using separate acceleration/deceleration times, control can be carried out with different acceleration/deceleration times for positioning control, JOG operation, home position return, etc.

Set the required values for the acceleration/deceleration time in the parameters shown in the following table, and write them to the Simple Motion module.

The set details are validated when written to the Simple Motion module.

| Setting item | | Setting value | Setting details | Factory-set initial value |
|---|---|---|---|---|
| [Pr.9] | Acceleration time 0 | → | Set the acceleration time at a value within the range of 1 to 8388608 ms. | 1000 |
| [Pr.25] | Acceleration time 1 | → | | 1000 |
| [Pr.26] | Acceleration time 2 | → | | 1000 |
| [Pr.27] | Acceleration time 3 | → | | 1000 |
| [Pr.10] | Deceleration time 0 | → | Set the deceleration time at a value within the range of 1 to 8388608 ms. | 1000 |
| [Pr.28] | Deceleration time 1 | → | | 1000 |
| [Pr.29] | Deceleration time 2 | → | | 1000 |
| [Pr.30] | Deceleration time 3 | → | | 1000 |

Refer to the following for the setting details.

☞ Page 407 Basic Setting

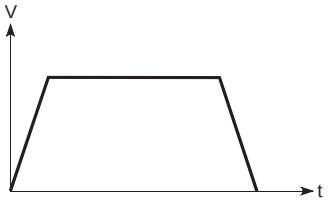
## "Acceleration/deceleration method setting" control details and setting

In the "acceleration/deceleration method setting", the acceleration/deceleration processing method is selected and set. The set acceleration/deceleration processing is applied to all acceleration/deceleration. (except for inching operation, manual pulse generator operation and speed-torque control.)

The two types of "acceleration/deceleration processing method" are shown below.

### ■Trapezoidal acceleration/deceleration processing method

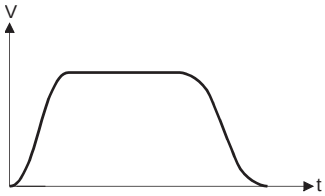
This is a method in which linear acceleration/deceleration is carried out based on the acceleration time, deceleration time, and speed limit value set by the user.



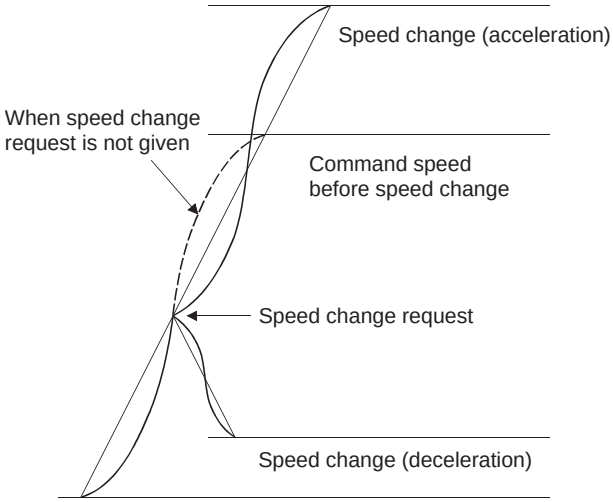
### ■S-curve acceleration/deceleration processing method

In this method, the motor burden is reduced during starting and stopping.

This is a method in which acceleration/deceleration is carried out gradually, based on the acceleration time, deceleration time, speed limit value, and "[Pr.35] S-curve ratio" (1 to 100%) set by the user.




When a speed change request or override request is given during S-curve acceleration/deceleration processing, S-curve acceleration/deceleration processing begins at a speed change request or override request start.


Speed change (acceleration)
When speed change request is not given
Command speed before speed change
Speed change request
Speed change (deceleration)

Set the required values for the "acceleration/deceleration method setting" in the parameters shown in the following table, and write them to the Simple Motion module.

The set details are validated when written to the Simple Motion module.

| Setting item | | Setting value | Setting details | Factory-set initial value |
|---|---|---|---|---|
| [Pr.34] | Acceleration/deceleration process selection | → | Set the acceleration/deceleration method.<br>0: Trapezoidal acceleration/deceleration processing<br>1: S-curve acceleration/deceleration processing | 0 |
| [Pr.35] | S-curve ratio | → | Set the acceleration/deceleration curve when "1" is set in "[Pr.34] Acceleration/deceleration process selection". | 100 |

Refer to the following for the setting details.

☞ Page 407 Basic Setting

**Point**

- Parameters are set for each axis.
- It is recommended that the parameters be set whenever possible with the engineering tool. Execution by a program uses many programs and devices. The execution becomes complicated, and the scan times will increase.

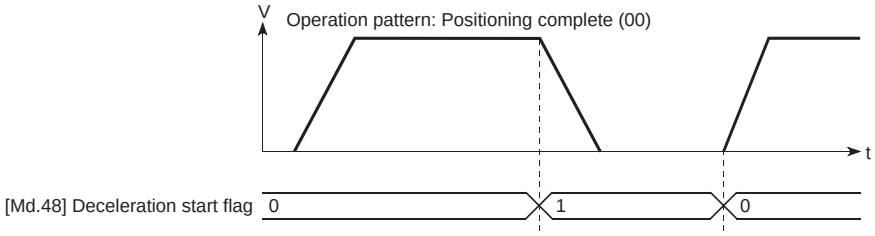
# Deceleration start flag function

The "deceleration start flag function" turns ON the flag when the constant speed status or acceleration status switches to the deceleration status during position control whose operation pattern is "Positioning complete". This function can be used as a signal to start the operation to be performed by other equipment at each end of position control or to perform preparatory operation, etc. for the next position control.

## Control details

When deceleration for a stop is started in the position control whose operation pattern is "Positioning complete", "1" is stored into "[Md.48] Deceleration start flag". When the next operation start is made or the manual pulse generator operation enable status is gained, "0" is stored. (Reference to the figure below)

### ■Start made with positioning data No. specified



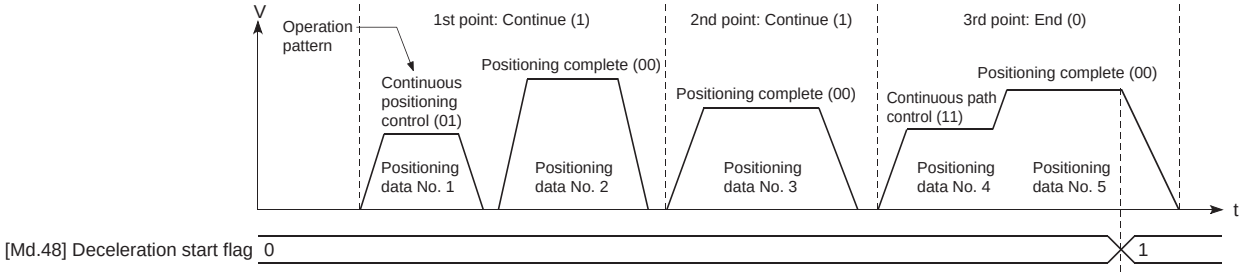

### ■Block start

At a block start, this function is valid for only the position control whose operation pattern is "Positioning complete" at the point whose shape has been set to "End". (Reference to the figure below)

The following table indicates the operation of the deceleration start flag in the case of the following block start data and positioning data.

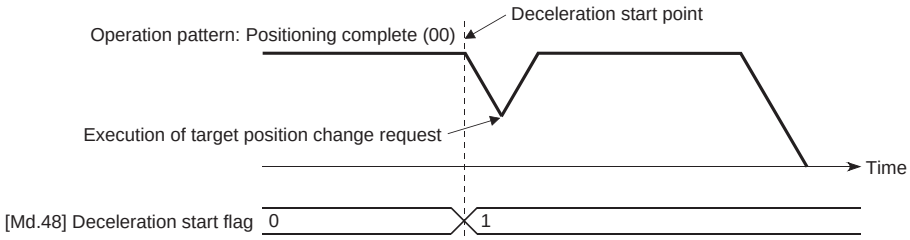
| Block start data | [Da.11] Shape | [Da.12] Start data No. | [Da.13] Special start instruction |
|---|---|---|---|
| 1st point | 1: Continue | 1 | 0: Block start |
| 2nd point | 1: Continue | 3 | 0: Block start |
| 3rd point | 0: End | 4 | 0: Block start |
| ⋮ | | | |
| ⋮ | | | |

| Positioning Data No. | [Da.1] Operation pattern |
|---|---|
| 1 | 01: Continuous positioning control |
| 2 | 00: Positioning complete |
| 3 | 00: Positioning complete |
| 4 | 11: Continuous path control |
| 5 | 00: Positioning complete |
| ⋮ | |
| ⋮ | |

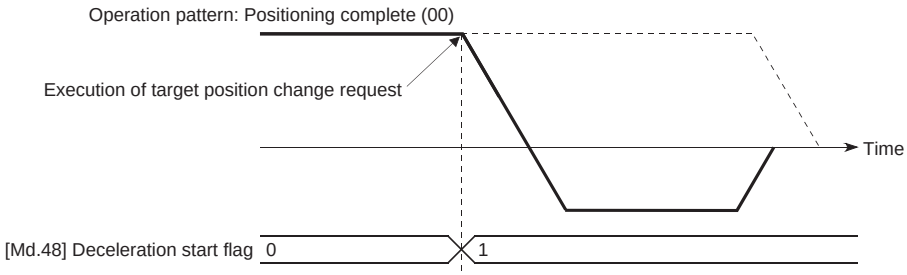


## Precautions during control

- The deceleration start flag function is valid for the control method of "1-axis linear control", "2-axis linear interpolation control", "3-axis linear interpolation control", "4-axis linear interpolation control", "speed-position switching control" or "position-speed switching control". In the case of linear interpolation control, the function is valid for only the reference axis. (MELSEC iQ-R Simple Motion Module User's Manual (Startup))
- The deceleration start flag does not turn ON when the operation pattern is "continuous positioning control" or "continuous path control".
- The deceleration start flag function is invalid for a home position return, JOG operation, inching operation, manual pulse generator operation, speed-torque control and deceleration made with a stop signal.
- The deceleration start flag does not turn ON when a speed change or override is used to make deceleration.
- If a target position change is made while the deceleration start flag is ON, the deceleration start flag remains ON.




- When the movement direction is reversed by a target position change, the deceleration start flag turns ON.




- During position control of position-speed switching control, the deceleration start flag is turned ON by automatic deceleration. The deceleration start flag remains ON if position control is switched to speed control by the position-speed switching signal after the deceleration start flag has turned ON.
- If the condition start of a block start is not made since the condition is not satisfied, the deceleration start flag turns ON when the shape is "End".
- When an interrupt request during continuous operation is issued, the deceleration start flag turns ON at a start of deceleration in the positioning data being executed.

## Setting method

To use the "deceleration start flag function", set "1" to the following control data using a program.

The set data is made valid on the rising edge (OFF to ON) of the PLC READY signal [Y0].

| Setting item | | Setting value | Setting details | Buffer memory address |
|---|---|---|---|---|
| [Cd.41] | Deceleration start flag valid | → | Set whether the deceleration start flag function is made valid or invalid.<br>0: Deceleration start flag invalid<br>1: Deceleration start flag valid | 5905 |

Refer to the following for the setting details.

☞ Page 504 Control Data

## Checking of deceleration start flag

The "deceleration start flag" is stored into the following buffer memory addresses.

n: Axis No. - 1

| Monitor item | | Monitor value | Storage details | Buffer memory address |
|---|---|---|---|---|
| [Md.48] | Deceleration start flag | → | 0: Status other than below<br>1: Status from deceleration start to next operation start or manual pulse generator operation enable | 2499+100n |

Refer to the following for information on the storage details.

☞ Page 468 Monitor Data

# Speed control 10 times multiplier setting for degree axis function

The "Speed control 10 × multiplier setting for degree axis function" is provided to execute the positioning control by 10 × speed of the setting value in the command speed and the speed limit value when the setting unit is "degree".

## Control details

When "Speed control 10 multiplier specifying function for degree axis" is valid, this function related to the command speed, monitor data, speed limit value, is shown below.

### ■Command speed

- Parameters

- "[Pr.7] Bias speed at start"
- "[Pr.46] Home position return speed"
- "[Pr.47] Creep speed"
- "[Cd.14] New speed value"
- "[Cd.17] JOG speed"
- "[Cd.25] Position-speed switching control speed change register"
- "[Cd.28] Target position change value (New speed)"
- "[Cd.140] Command speed at speed control mode"
- "[Da.8] Command speed"

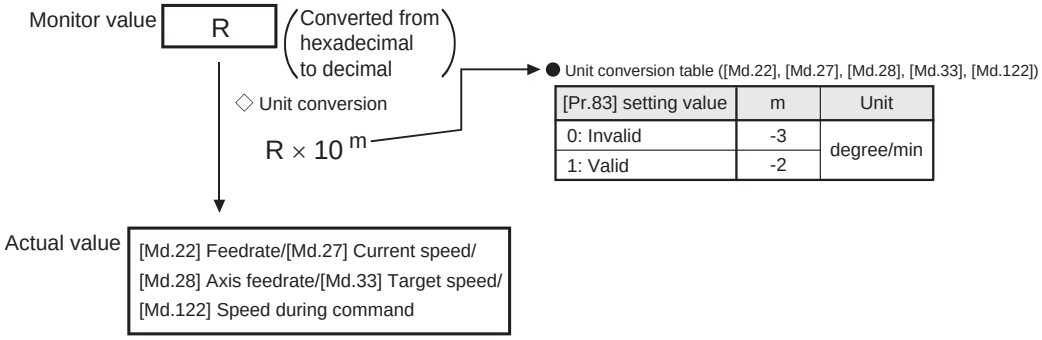
- Major positioning control

- For "2 to 4 axis linear interpolation control" and "2 to 4 axis fixed-feed control", the positioning control is performed at decuple speed of command speed, when "[Pr.83] Speed control 10 × multiplier setting for degree axis" of reference axis is valid.
- For "2 to 4 axis speed control", "[Pr.83] Speed control 10 × multiplier setting for degree axis" is evaluated whether it is valid for each axis. If valid, the positioning control will be performed at decuple speed of command speed.

### ■Monitor data

- "[Md.22] Feedrate"
- "[Md.27] Current speed"
- "[Md.28] Axis feedrate"
- "[Md.33] Target speed"
- "[Md.122] Speed during command"

*1 For the above monitoring data, "[Pr.83] Speed control 10 × multiplier setting for degree axis" is evaluated whether it is valid for each axis. If valid, unit conversion value is changed ($\times 10^{-3} \rightarrow \times 10^{-2}$). The unit conversion table of monitor value is shown below.




| [Pr.83] setting value | m | Unit |
|---|---|---|
| 0: Invalid | -3 | degree/min |
| 1: Valid | -2 | |

### ■Speed limit value

- "[Pr.8] Speed limit value"
- "[Pr.31] JOG speed limit value"
- "[Cd.146] Speed limit value at torque control mode"
- "[Cd.147] Speed limit value at continuous operation to torque control mode"

*1 For the speed limit value, "[Pr.83] Speed control 10 × multiplier setting for degree axis" is evaluated whether it is valid for each axis. If valid, the positioning control will be performed at decuple speed of setting value (max. speed).

## Setting method

Set "Valid/Invalid" by "[Pr.83] Speed control 10 × multiplier setting for degree axis".

Normally, the speed specification range is 0.001 to 2000000.000 [degree/min], but it will be decupled and become 0.01 to 20000000.00 [degree/min] by setting "[Pr.83] Speed control 10 × multiplier setting for degree axis" to valid.

To use the "Speed control 10 × multiplier setting for degree axis function", set the parameters shown in the following table.

n: Axis No. - 1

| Setting item | | Setting value | Setting details | Buffer memory address |
|---|---|---|---|---|
| [Pr.83] | Speed control 10 × multiplier setting for degree axis | → | Set the speed control 10 × multiplier setting for degree axis.<br>0: Invalid<br>1: Valid | 63+150n |

Refer to the following for the setting details.

☞ Page 407 Basic Setting

# Operation setting for incompletion of home position return function

The "Operation setting for incompletion of home position return function" is provided to select whether positioning control is operated or not when the home position return request flag is ON.

## Control details

When "[Pr.55] Operation setting for incompletion of home position return" is valid, this function related to the command speed, monitor data, speed limit value, is shown below.

○: Positioning start possible (Execution possible), ×: Positioning start impossible (Execution not possible)

| Positioning control | [Pr.55] Operation setting for incompletion of home position return | |
|---|---|---|
| | "0: Positioning control is not executed." and "home position return request flag ON" | "1: Positioning control is executed." and "home position return request flag ON" |
| • Machine home position return<br>• JOG operation<br>• Inching operation<br>• Manual pulse generator operation<br>• Current value changing using current value changing start No. (No. 9003). | ○ | ○ |
| When the following cases at block start, condition start, wait start, repeated start, multiple axes simultaneous start and pre-reading start<br>• 1-axis linear control<br>• 2/3/4-axis linear interpolation control<br>• 1/2/3/4-axis fixed-feed control<br>• 2-axis circular interpolation control (with sub point designation/center point designation)<br>• 3-axis helical interpolation control (with sub point designation/center point designation)<br>• 1/2/3/4-axis speed control<br>• Speed-position switching control (INC mode/ ABS mode)<br>• Position-speed switching control<br>• Current value changing using positioning data No. (No.1 to 600). | × | ○ |
| Control mode switching | × | ○ |

## Precautions during control

- The error "Start at home position return incomplete" (error code: 19A6H) occurs if the home position return request flag ([Md.31] Status: b3) is executed the positioning control by turning on, when "0: Positioning control is not executed" is selected the operation setting for incompletion of home position return setting, and positioning control will not be performed. At this time, operation with the manual control (JOG operation, inching operation, manual pulse generator operation) is available.
- When the home position return request flag ([Md.31] Status: b3) is ON, starting Fast home position return will result in the error "Home position return request ON" (error code: 1945H) despite the setting value of "[Pr.55] Operation setting for incompletion of home position return", and Fast home position return will not be performed.

## Setting method

To use the "Operation setting for incompletion of home position return", set the following parameters using a program.

n: Axis No. - 1

| Setting item | | Setting value | Setting details | Buffer memory address |
|---|---|---|---|---|
| [Pr.55] | Operation setting for incompletion of home position return | → | Set the operation setting for incompletion of home position return.<br>0: Positioning control is not executed.<br>1: Positioning control is executed. | 87+150n |

Refer to the following for the setting details.

☞ Page 407 Basic Setting

# 8.10 Servo ON/OFF

## Servo ON/OFF

This function executes servo ON/OFF of the servo amplifiers connected to the Simple Motion module.
By establishing the servo ON status with the servo ON command, servo motor operation is enabled.
The following two signals can be used to execute servo ON/OFF.

- All axis servo ON [Y1]
- [Cd.100] Servo OFF command (Buffer memory addresses: 4351+100n)

A list of the "All axis servo ON [Y1]" and "[Cd.100] Servo OFF command" is given below.
○: Servo ON (Servo operation enabled)
×: Servo OFF (Servo operation disabled)

| Setting item | | [Cd.100] Servo OFF command | | | |
|---|---|---|---|---|---|
| | | Setting value "0" | Command to servo amplifier | Setting value "1" | Command to servo amplifier |
| All axis servo ON: Y1 | OFF | × | Servo ON command: OFF<br>Ready ON command: OFF | × | Servo ON command: OFF<br>Ready ON command: OFF |
| | ON | ○ | Servo ON command: ON<br>Ready ON command: ON | × | Servo ON command: OFF<br>Ready ON command: ON |

**Point**

When the delay time of "Electromagnetic brake sequence output (PC02)" is used, execute the servo ON to OFF by "[Cd.100] Servo OFF command". (When all axis servo ON [Y1] is turned ON to OFF, execute the servo OFF and turn off [Y1] after delay time passes.)
Refer to each servo amplifier instruction manual for details of servo ON command OFF and ready ON command OFF from Simple Motion module.

### Servo ON (Servo operation enabled)

The following shows the procedure for servo ON.

***1.*** Make sure that the servo LED indicates "b☐".
(The initial value for "All axis servo ON [Y1]" is "OFF".)

***2.*** Set "0" for "[Cd.100] Servo OFF command".

***3.*** Turn ON "All axis servo ON [Y1]".
Now the servo amplifier turns ON the servo (servo operation enabled state). (The servo LED indicates "d☐".)

### Servo OFF (Servo operation disabled)

The following shows the procedure for servo OFF.

***1.*** Set "1" for "[Cd.100] Servo OFF command". (The servo LED indicates "c☐".)
(If the "[Cd.100] Servo OFF command" set "0" again, after the servo operation enabled.)

***2.*** Turn OFF "All axis servo ON [Y1]".
(The servo LED indicates "b☐".)

**Point**

- If the servomotor is rotated by external force during the servo OFF status, follow up processing is performed.
- Change between servo ON or OFF status while operation is stopped (position control mode). The servo OFF command of during positioning in position control mode, manual pulse control, home position return, speed control mode, torque control mode and continuous operation to torque control mode will be ignored.
- When the servo OFF is given to all axes, "All axis servo ON [Y1]" is applied even if all axis servo ON command is turned ON to OFF with "[Cd.100] Servo OFF command" set "0".

# Follow up function

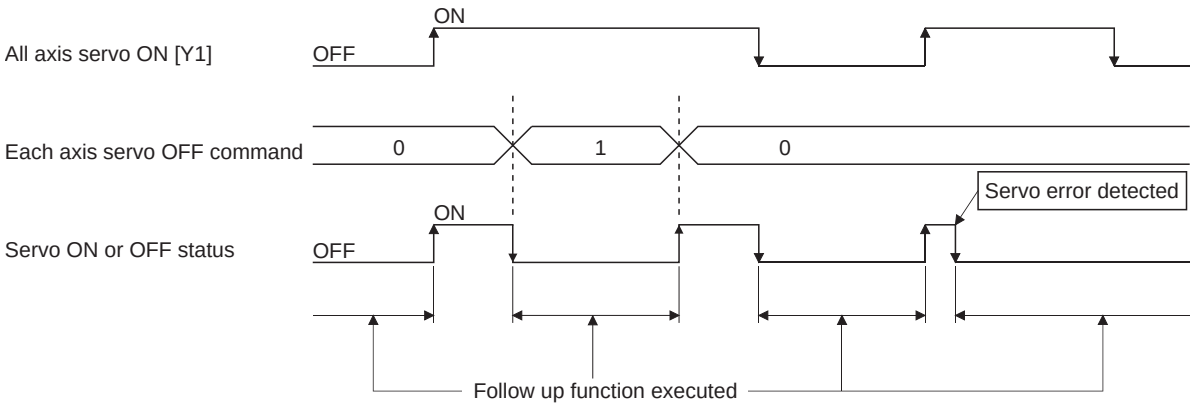
## Follow up function

The follow up function monitors the number of motor rotations (actual present value) with the servo OFF and reflects the value in the present feed value.

If the servomotor rotates during the servo OFF, the servomotor will not just rotate for the amount of droop pulses at switching the servo ON next time, so that the positioning can be performed from the stop position.

## Execution of follow up

Follow up function is executed continually during the servo OFF status.




**Point**

The follow-up function performs the process if the "Simple Motion module and the servo amplifier is turned ON" and "servo OFF" regardless of the presence of the absolute position system.

# 9 COMMON FUNCTIONS



The details and usage of the "common functions" executed according to the user's requirements are explained in this chapter.
Common functions include functions required when using the Simple Motion module, such as parameter initialization and execution data backup.
Read the setting and execution procedures for each common function indicated in this chapter thoroughly, and execute the appropriate function where required.

## 9.1 Outline of Common Functions

"Common functions" are executed according to the user's requirements, regardless of the control method, etc.
These common functions are executed by an engineering tool or programs.
The following table shows the functions included in the "common functions".

| Common function | Details | Means | |
|---|---|---|---|
| | | Program | Engineering tool |
| Parameter initialization function | This function returns the setting data stored in the buffer memory/internal memory and flash ROM/internal memory (nonvolatile) of Simple Motion module to the default values. | ○ | ○ |
| Execution data backup function | This function writes the "execution data", currently being used for control, to the flash ROM/internal memory (nonvolatile). | ○ | ○ |
| External input signal select function | This function sets the input type, input terminal, signal logic and input filter for each external input signal of each axis (upper/lower stroke limit signal (FLS/RLS), near-point dog signal (DOG), and stop signal (STOP)).<br>The function enables the assignment of external input signal of each axis to any terminals of 20 points of the external input connection connector on the Simple Motion module. | ○ | ○ |
| History monitor function | This function monitors start history and current value history of all axes. | — | ○ |
| Amplifier-less operation function | This function executes the positioning control of Simple Motion module without connecting to the servo amplifiers. It is used to debug the program at the start-up of the device or simulate the positioning operation. | ○ | — |
| Virtual servo amplifier function | This function executes the operation as the axis (virtual servo amplifier axis) that operates only command (instruction) virtually without servo amplifiers. | ○ | ○ |
| Driver communication function | This function uses the "Master-slave operation function" of servo amplifier. The Simple Motion module controls the master axis and the slave axis is controlled by data communication between servo amplifiers (driver communication) without Simple Motion module. | ○ | ○ |
| Mark detection function | This function is used to latch any data at the input timing of the mark detection signal (DI). | ○ | ○ |
| Optional data monitor function | This function is used to store the data selected by user up to 4 data per axis to buffer memory and monitor them. | ○ | ○ |
| Event history function | This function collects errors and event information occurred in the Simple Motion module in the CPU module, and saves them to an SD memory card.<br>This function enables to check the error history even after the power OFF or reset by holding the error contents in the CPU module. | — | ○ |
| Connect/disconnect function of SSCNET communication | Temporarily connect/disconnect of SSCNET communication is executed during system's power supply ON. This function is used to exchange the servo amplifiers or SSCNETⅢ cables. | ○ | — |
| Online module change | Allows to replace a module without stopping the system. For procedures for the online module change, refer to the following.<br>📖MELSEC iQ-R Online Module Change Manual | | |
| Hot line forced stop function | This function is used to execute deceleration stop safety for other axes when the servo alarm occurs in the servo amplifier MR-JE-B. | ○ | ○ |

# 9.2 Parameter Initialization Function

The "parameter initialization function" is used to return the setting data set in the buffer memory/internal memory and flash ROM/internal memory (nonvolatile) of Simple Motion module to the default values.

## Parameter initialization means

- Initialization is executed with a program.
- Initialization is executed by an engineering tool.

Refer to the "Simple Motion Module Setting Function Help" for the execution method by an engineering tool.

## Control details

The following table shows the setting data initialized by the "parameter initialization function".
(The data initialized are "buffer memory/internal memory" and "flash ROM/internal memory (nonvolatile)" setting data.)

| Setting data |
|---|
| Parameters |
| Servo parameters |
| Positioning data |
| Block start data |
| Input axis parameters |
| Synchronous encoder axis parameters |
| Main shaft/auxiliary shaft parameters |
| Main shaft/auxiliary shaft clutch parameters |
| Speed change gear parameters |
| Output axis parameters |
| Synchronous control initial position parameters |
| Mark detection setting parameters |

## Precautions during control

- Parameter initialization is only executed when the positioning control is not carried out (when the PLC READY signal [Y0] is OFF). The warning "In PLC READY" (warning code: 0905H) will occur if executed when the PLC READY signal [Y0] is ON.
- Writing to the flash ROM is up to 100,000 times. If writing to the flash ROM exceeds 100,000 times, the writing may become impossible, and the error "Flash ROM write error" (error code: 1931H) will occur.
- A "CPU module reset" or "CPU module power restart" must be carried out after the parameters are initialized.
- If an error occurs on the parameter set in the Simple Motion module when the PLC READY signal [Y0] is turned ON, the READY signal [X0] will not be turned ON and the control cannot be carried out.

**Restriction**

The writing time to the flash ROM is up to 5 seconds. Parameter initialization takes up to 5 seconds.
Do not turn the power ON/OFF or reset the CPU module during parameter initialization.
If the power is turned OFF or the CPU module is reset to forcibly end the process, the data backed up in the flash ROM/internal memory (nonvolatile) will be lost.

## Parameter initialization method

- Parameter initialization can be carried out by writing the data shown in the table below to the buffer memory of Simple Motion module. The initialization of the parameter is executed at the time point the data is written to the buffer memory of Simple Motion module.

| Setting item | | Setting value | Setting details | Buffer memory address |
|---|---|---|---|---|
| [Cd.2] | Parameter initialization request | 1 | Set "1" (parameter initialization request). | 5901 |

Refer to the following for the setting details.

☞ Page 504 Control Data

When the initialization is complete, "0" will be set in "[Cd.2] Parameter initialization request" by the Simple Motion module automatically.

# 9.3 Execution Data Backup Function

When the buffer memory data of Simple Motion module is rewritten from the CPU module, "the data backed up in the flash ROM/internal memory (nonvolatile)" of Simple Motion module may differ from "the execution data being used for control (buffer memory data)". In this case, the execution data will be lost when the power supply of CPU module is turned OFF. The "execution data backup function" is used to back up the execution data by writing to the flash ROM/internal memory (nonvolatile). The data backed up will be written to the buffer memory when the power is turned ON next time.

## Execution data backup means

- The backup is executed with a program.
- The data is written to the flash ROM by an engineering tool.

Refer to the "Simple Motion Module Setting Function Help" for the flash ROM write method by an engineering tool.

## Control details

The following shows the data that can be written to the flash ROM/internal memory (nonvolatile) using the "execution data backup function".

| Buffer memory/Internal memory | | Flash ROM/Internal memory (nonvolatile) |
|---|---|---|
| Parameters | → | Parameters |
| Positioning data | | Positioning data |
| Block start data | | Block start data |
| Servo parameters | | Servo parameters |
| Input axis parameters | | Input axis parameters |
| Synchronous encoder axis parameters | | Synchronous encoder axis parameters |
| Main shaft/auxiliary shaft parameters | | Main shaft/auxiliary shaft parameters |
| Main shaft/auxiliary shaft clutch parameters | | Main shaft/auxiliary shaft clutch parameters |
| Speed change gear parameters | | Speed change gear parameters |
| Output axis parameters | | Output axis parameters |
| Synchronous control initial position parameters | | Synchronous control initial position parameters |
| Mark detection setting parameters | | Mark detection setting parameters |

## Precautions during control

- Data can only be written to the flash ROM when the positioning control is not carried out (when the PLC READY signal [Y0] is OFF). The warning "In PLC READY" (warning code: 0905H) will occur if executed when the PLC READY signal [Y0] is ON.
- Writing to the flash ROM can be executed up to 100,000 times. If writing to the flash ROM exceeds 100,000 times, the writing may become impossible, and the error "Flash ROM write error" (error code: 1931H) will occur.
- After the power supply is turned ON or the CPU module is reset once, writing to the flash ROM using a program is limited to up to 25 times. If the 26th writing is executed, the error "Flash ROM write number error" (error code: 1080H) will occur. If this error occurs, carry out the error reset or power OFF → ON/CPU module reset operation again.

**Restriction**

The writing time to the flash ROM is up to 5 seconds. Do not turn the power ON/OFF or reset the CPU module during executing the flash ROM writing.
If the power is turned OFF or the CPU module is reset to forcibly end the process, the data backed up in the flash ROM/internal memory (nonvolatile) will be lost.

## Execution data backup method

- Refer to the following for the data transmission processing at the backup of the execution data.

☞ Page 546 Data transmission process

- Execution data backup can be carried out by writing the data shown in the table below to the buffer memory of Simple Motion module. The writing to the flash ROM/internal memory (nonvolatile) is executed at the time point the data is written to the buffer memory of Simple Motion module.

| Setting item | | Setting value | Setting details | Buffer memory address |
|---|---|---|---|---|
| [Cd.1] | Flash ROM write request | 1 | Set "1" (flash ROM write request). | 5900 |

Refer to the following for the setting details.

☞ Page 504 Control Data

When the writing to the flash ROM/internal memory (nonvolatile) is complete, "0" will be set in "[Cd.1] Flash ROM write request" by the Simple Motion module automatically.

# 9.4 External Input Signal Select Function

The "external input signal select function" sets the input type, input terminal, signal logic and input filter for each external input signal of each axis (upper/lower stroke limit signal (FLS/RLS), near-point dog signal (DOG), and stop signal (STOP)).
The function enables the assignment of external input signal of each axis to any terminals of 20 points of the external input connection connector on the Simple Motion module.

## Input type/input terminal setting method

This function sets the input type and input terminal used for the external input signals used in each axis (upper/lower stroke limit signal (FLS/RLS), near-point dog signal (DOG), and stop signal (STOP)). The setting method is shown below.

| Setting item | | Initial value | Setting details |
|---|---|---|---|
| [Pr.116] | FLS signal selection | 0001H | ■Set with a hexadecimal.<br>H _ _ _ _<br>▶ Input type<br>Set the input type used as the external input signal.<br>0(0000H) : Simple Motion module<br>1(0001H) : Servo amplifier*1<br>2(0002H) : Buffer memory<br>15(000FH) : Invalid<br>▶ Input terminal<br>When the input type is set with "0: Simple Motion module", set the input terminal of the external input connection connector to be used.<br>The setting value can be set until "0AH" at RD77MS2 use.<br>The setting is not required when the value other than "0" is set. (The setting is ignored.) |
| [Pr.117] | RLS signal selection | 0001H | |
| [Pr.118] | DOG signal selection | 0001H | |
| [Pr.119] | STOP signal selection | 0002H | |

*1 The setting is not available in "[Pr.119] STOP signal selection". If it is set, the error "STOP signal selection error" (error code: 1AD3H) occurs and the PLC READY signal [Y0] is not turned ON.
*2 The input terminals corresponding to the setting values are shown in the following table. "00H" is set as "No setting". (The control by the external input signal is disabled.)

| Setting value | Pin No. | Input terminal | Setting value | Pin No. | Input terminal |
|---|---|---|---|---|---|
| 01H | 1A1 | SIN1 | 0BH | 2A1 | SIN11 |
| 02H | 1A2 | SIN2 | 0CH | 2A2 | SIN12 |
| 03H | 1A3 | SIN3 | 0DH | 2A3 | SIN13 |
| 04H | 1A4 | SIN4 | 0EH | 2A4 | SIN14 |
| 05H | 1A5 | SIN5 | 0FH | 2A5 | SIN15 |
| 06H | 1B1 | SIN6 | 10H | 2B1 | SIN16 |
| 07H | 1B2 | SIN7 | 11H | 2B2 | SIN17 |
| 08H | 1B3 | SIN8 | 12H | 2B3 | SIN18 |
| 09H | 1B4 | SIN9 | 13H | 2B4 | SIN19 |
| 0AH | 1B5 | SIN10 | 14H | 2B5 | SIN20 |

### ■Point for input type/input terminal setting method

- Set the external command signal (DI) using "[Pr.95] External command signal selection". As for the terminal of the external input connection connector of the Simple Motion module, DI number is defined to each SIN number in advance.
- When the input type of "[Pr.116] FLS signal selection" to "[Pr.119] STOP signal selection" is set with "0: Simple Motion module", the external input connection connector terminal of the Simple Motion module is used in duplicate with the external command signal (DI). The available range is shown below.

  - RD77MS2: 1A1 to 1A5, 1B1 to 1B5
  - RD77MS4/RD77MS8/RD77MS16: 1A1 to 1A5, 1B1 to 1B5, 2A1 to 2A5, 2B1 to 2B5

| Pin No. | DI No. | Definition of FLS/ RLS/DOG/STOP | Pin No. | DI No. | Definition of FLS/ RLS/DOG/STOP |
|---|---|---|---|---|---|
| 1A1 | DI1 | The signal set with the input terminal setting in "[Pr.116] FLS signal selection" to "[Pr.119] STOP signal selection". | 2A1 | DI11 | The signal set with the input terminal setting in "[Pr.116] FLS signal selection" to "[Pr.119] STOP signal selection". |
| 1A2 | DI2 | | 2A2 | DI12 | |
| 1A3 | DI3 | | 2A3 | DI13 | |
| 1A4 | DI4 | | 2A4 | DI14 | |
| 1A5 | DI5 | | 2A5 | DI15 | |
| 1B1 | DI6 | | 2B1 | DI16 | |
| 1B2 | DI7 | | 2B2 | DI17 | |
| 1B3 | DI8 | | 2B3 | DI18 | |
| 1B4 | DI9 | | 2B4 | DI19 | |
| 1B5 | DI10 | | 2B5 | DI20 | |

Set the input terminal and buffer memory number to be used for each setting value of the "external signal selection" such as "[Pr.116] FLS signal selection", "[Pr.117] RLS signal selection", "[Pr.118] DOG signal selection" and "[Pr.119] STOP signal selection".

### ■When "0: Simple Motion module" is set

The pin number to be used is set as the setting details (input terminal) of "[Pr.116] FLS signal selection", "[Pr.117] RLS signal selection", "[Pr.118] DOG signal selection", and "[Pr.119] STOP signal selection".

### ■When "1: Servo amplifier" is set

The following table shows the pin number of the external input signal of the servo amplifier to be used.
(Note): When setting at MR-JE-B use, any errors or warnings do not occur. However, the external input signal (upper/lower limit signal, near-point dog signal) cannot be operated.

| Pin No. of servo amplifier*1 | Signal name |
|---|---|
| CN3-19(DI3) | DOG |
| CN3-12(DI2) | RLS |
| CN3-2(DI1) | FLS |

*1 This servo amplifier means about MR-J4_B/MR-JE-_B. Refer to the "Servo Amplifier Instruction Manual" for details on the pin numbers of MR-J4W_-_B.
*2 The stop signal cannot be input from the external input signal of the servo amplifier.

### ■When "2: Buffer memory" is set

Uses the control data shown below to operate the external input signals (upper/lower stroke limit signal, near-point dog signal, and stop signal).

| Setting item | | Setting value | Setting details | Buffer memory address |
|---|---|---|---|---|
| [Cd.44] | External input signal operation device (Axis 1 to 16) | → | Set the status of the upper/lower limit signal, the near-point dog signal and the stop signal. | 5928 to 5931 |

Refer to the following for the setting details.
☞ Page 504 Control Data

## Input logic setting method for external input signals

The signal logic can be switched according to the external input signals (upper/lower stroke limit signal (FLS/RLS), near-point dog signal (DOG), stop signal (STOP), and external command signal/switching signal (DI)) of the servo amplifier or external device connected with the Simple Motion module.
For the system that does not use the upper/lower limit signal with b-contact, this function enables the control without wiring by setting "Positive logic" to the parameter logic setting.
When using the upper/lower limit signal, be sure to use in the negative logic (b-contact).
For the interface of the logic selection, the setting area varies depending on the input type and signal type of the external signal.

| Input type of "[Pr.116] FLS signal selection" to "[Pr.119] STOP signal selection" | Signal type | Setting area |
|---|---|---|
| 0: Simple Motion module | FLS/RLS/DOG/STOP/DI | [Pr.150] Input terminal logic selection |
| | Manual pulse generator | [Pr.151] Manual pulse generator/Incremental synchronous encoder input logic selection |
| 1: Servo amplifier | FLS/RLS/DOG | [Pr.22] Input signal logic selection |
| 2: Buffer memory | FLS/RLS/DOG/STOP | |

### ■External input signals from the servo amplifier and buffer memory (upper/lower stroke limit signal (FLS/RLS), near-point dog signal (DOG), and stop signal (STOP))

Use the following parameter to switch the logic of the external input signals from the servo amplifier and buffer memory (upper/lower stroke limit signal (FLS/RLS), near-point dog signal (DOG), and stop signal (STOP)).

| Setting item | | Initial value | Setting details |
|---|---|---|---|
| [Pr.22] | Input signal logic selection | → | Select the logic of the signal which is input to the Simple Motion module from the external device.<br>0: Negative logic<br>1: Positive logic<br>(Always "0" is set to the part not used.) |

Refer to the following for the setting details.

☞ Page 407 Basic Setting

### ■External input signals from the external device connected with the Simple Motion module (upper/lower stroke limit signal (FLS/RLS), near-point dog signal (DOG), stop signal (STOP), and external command signal/switching signal (DI))

Use the following parameter to switch the logic of the external input signals from the external device connected with the Simple Motion module (upper/lower stroke limit signal (FLS/RLS), near-point dog signal (DOG), stop signal (STOP), and external command signal/switching signal (DI)).

| Setting item | | Initial value | Setting details |
|---|---|---|---|
| [Pr.150] | Input terminal logic selection | 0 | Select the logic for the input signal from the external device connected with the Simple Motion module.<br>0: ON at leading edge<br>(When the current is flowed through the input signal terminal: ON,<br>When the current is not flowed through the input signal terminal: OFF)<br>1: ON at trailing edge<br>(When the current is flowed through the input signal terminal: OFF,<br>When the current is not flowed through the input signal terminal: ON)<br>[Input terminal range]<br>RD77MS2: b0 to b9<br>RD77MS4/RD77MS8/RD77MS16: b0 to b19 |

Refer to the following for the setting details.

☞ Page 407 Basic Setting

### ■Manual pulse generator/Incremental synchronous encoder input

Use the following parameter to switch the external input signal logic for the manual pulse generator/incremental synchronous encoder.

| Setting item | | Initial value | Setting details |
|---|---|---|---|
| [Pr.151] | Manual pulse generator/ Incremental synchronous encoder input logic selection | 0 | Select the input signal logic to the Simple Motion module from the manual pulse generator/incremental synchronous encoder.<br>0: Negative logic<br>1: Positive logic |

Refer to the following for the setting details.

☞ Page 407 Basic Setting

### ■Precautions on parameter setting

- The logic switching parameters are validated when the PLC READY signal [Y0] is turned OFF to ON. (The logic is negative right after power-on.)
- If the logic of each signal is set erroneously, the operation may not be carried out correctly. Before setting, check the specifications of the equipment to be used.

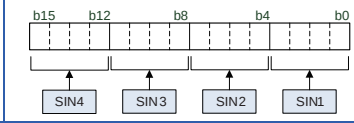
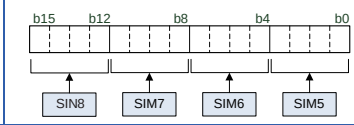
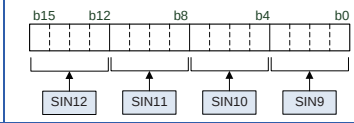
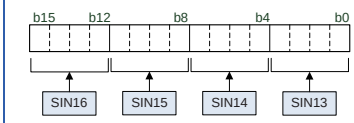
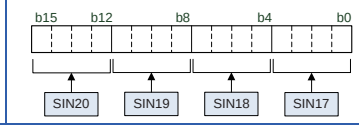
## Input filter setting method for external input signals

The input filter is used to suppress chattering when the external input signal is chattering by noise, etc.
The setting area of the input filter varies by the input type of "[Pr.116] FLS signal selection" to "[Pr.119] STOP signal selection".

| Input type of "[Pr.116] FLS signal selection" to "[Pr.119] STOP signal selection" | Setting area |
|---|---|
| 0: Simple Motion module | [Pr.153] External input signal digital filter setting |
| 1: Servo amplifier | Input filter setting (PD11)<br>(Servo parameter) |
| 2: Buffer memory | No setting (No input filter when the buffer memory is set.) |

### ■External input signals from the external device connected with the Simple Motion module (upper/lower stroke limit signal (FLS/RLS), near-point dog signal (DOG), stop signal (STOP), and external command signal/switching signal (DI))

Use the following parameter to set the input filter of the external input signals from the external device connected with the Simple Motion module (upper/lower stroke limit signal (FLS/RLS), near-point dog signal (DOG), stop signal (STOP), and external command signal/switching signal (DI)).

| Setting item | | Initial value | Setting details | | |
|---|---|---|---|---|---|
| [Pr.153] | External input signal digital filter setting | 6666H | Filter setting 1 |  | 0H: 3.2 ms<br>1H: 2.4 ms<br>2H: 1.6 ms<br>3H: 1.2 ms<br>4H: 0.8 ms<br>5H: 0.4 ms<br>6H: 0.2 ms |
| | | | Filter setting 2 |  | |
| | | | Filter setting 3 |  | |
| | | | Filter setting 4 |  | |
| | | | Filter setting 5 |  | |

### Precautions

- "[Pr.153] External input signal digital filter setting" is not a parameter for each axis.
- "[Pr.153] External input signal digital filter setting" becomes valid when the power supply is turned ON, the CPU module is reset, or the PLC READY signal [Y0] is turned ON.
- When lengthening the filter setting time, the signal detection timing will be slow.
- When "[Pr.153] External input signal digital filter setting" is set with a value other than "0 to 6", note that the module may cause a failure.

### ■External input signals from the servo amplifier (upper/lower stroke limit signal (FLS/RLS) and near-point dog signal (DOG))

Use the following parameter to set the input filter of the external input signals from the servo amplifier (upper/lower stroke limit signal (FLS/RLS) and near-point dog signal (DOG)).

| Setting item | | Initial value | Setting details |
|---|---|---|---|
| PD11 | Input filter setting | 4H | ■Set with a hexadecimal.<br>Setting value H 0 0 0 □<br>● Input filter setting<br>0H: None<br>1H: 0.888 ms<br>2H: 1.777 ms<br>3H: 2.666 ms<br>4H: 3.555 ms |

## Precautions

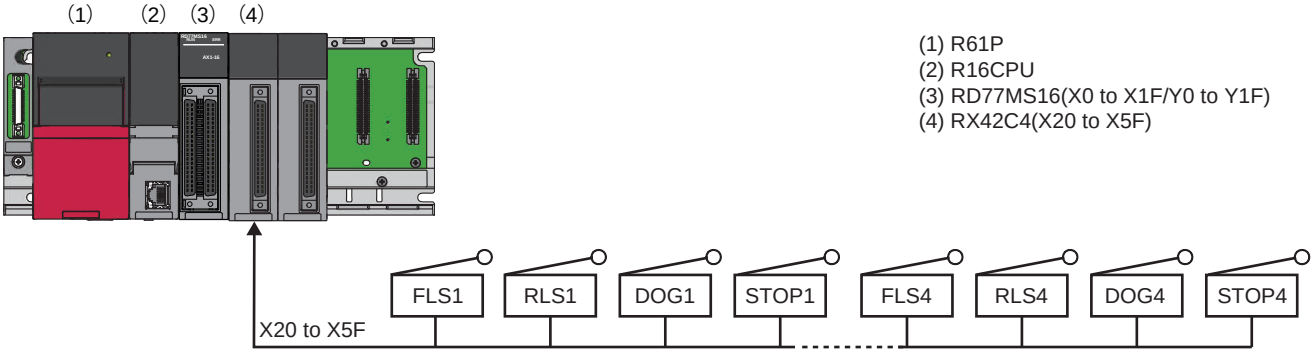
- The servo parameter is transferred from the Simple Motion module to the servo amplifier after the power supply is turned ON or the CPU module is reset.
- The input filter setting of the servo parameter (PD11) becomes valid when the power supply of the servo amplifier is turned ON from OFF. After executing the above process, turn the power supply of the servo amplifier ON from OFF and turn the power supply of the system or reset the CPU module again.

## Program example

The following shows the program example to operate "[Cd.44] External input signal operation device (Axis 1 to 16)" of axis 1, axis 4, axis 8, and axis 16 using the limit switch connected to the input module when "2: Buffer memory" is set in "[Pr.116] FLS signal selection" to "[Pr.119] STOP signal selection".

### ■System configuration

The following figure shows the system configuration used for the program examples.



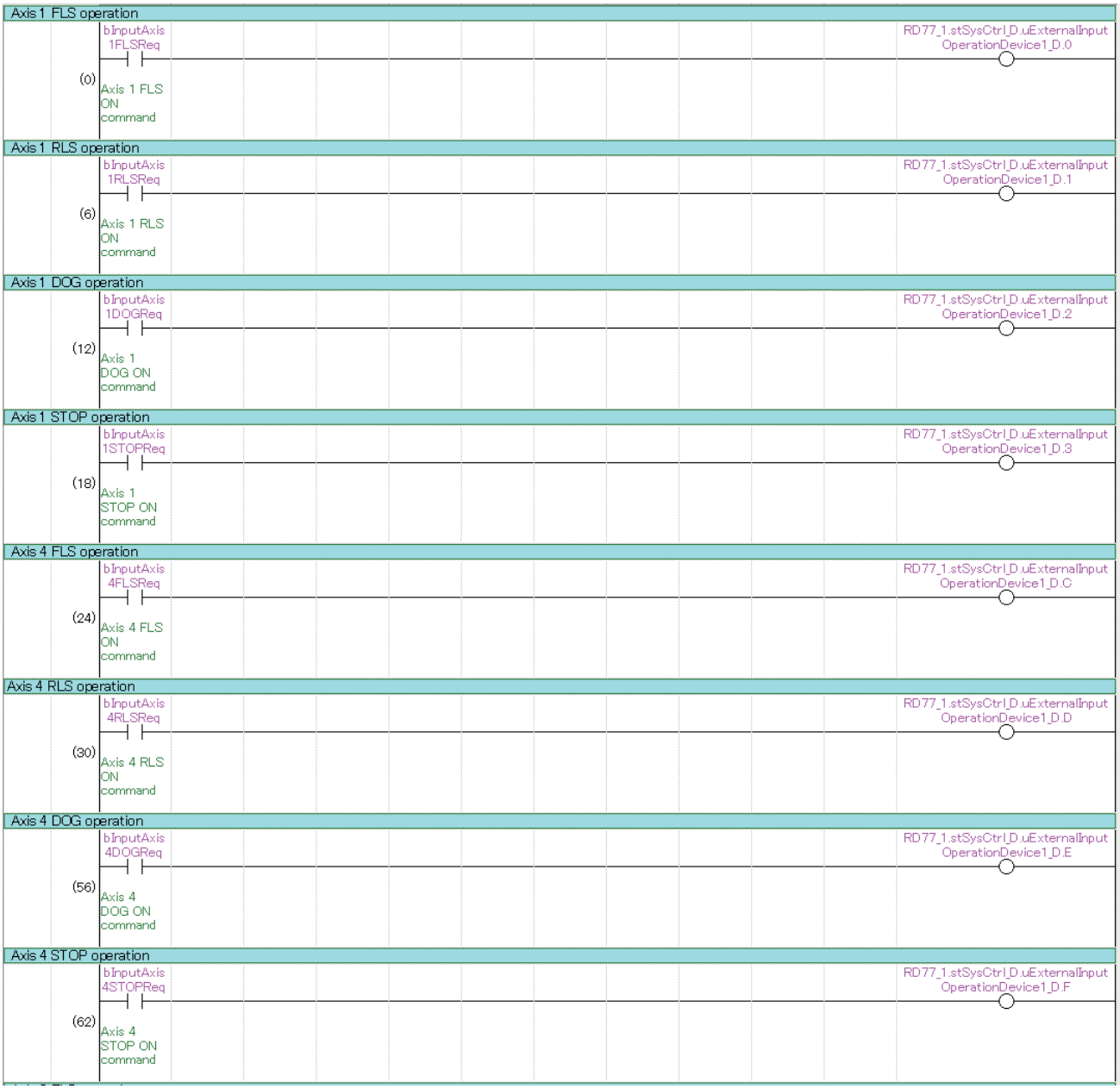
## ■List of labels to be used

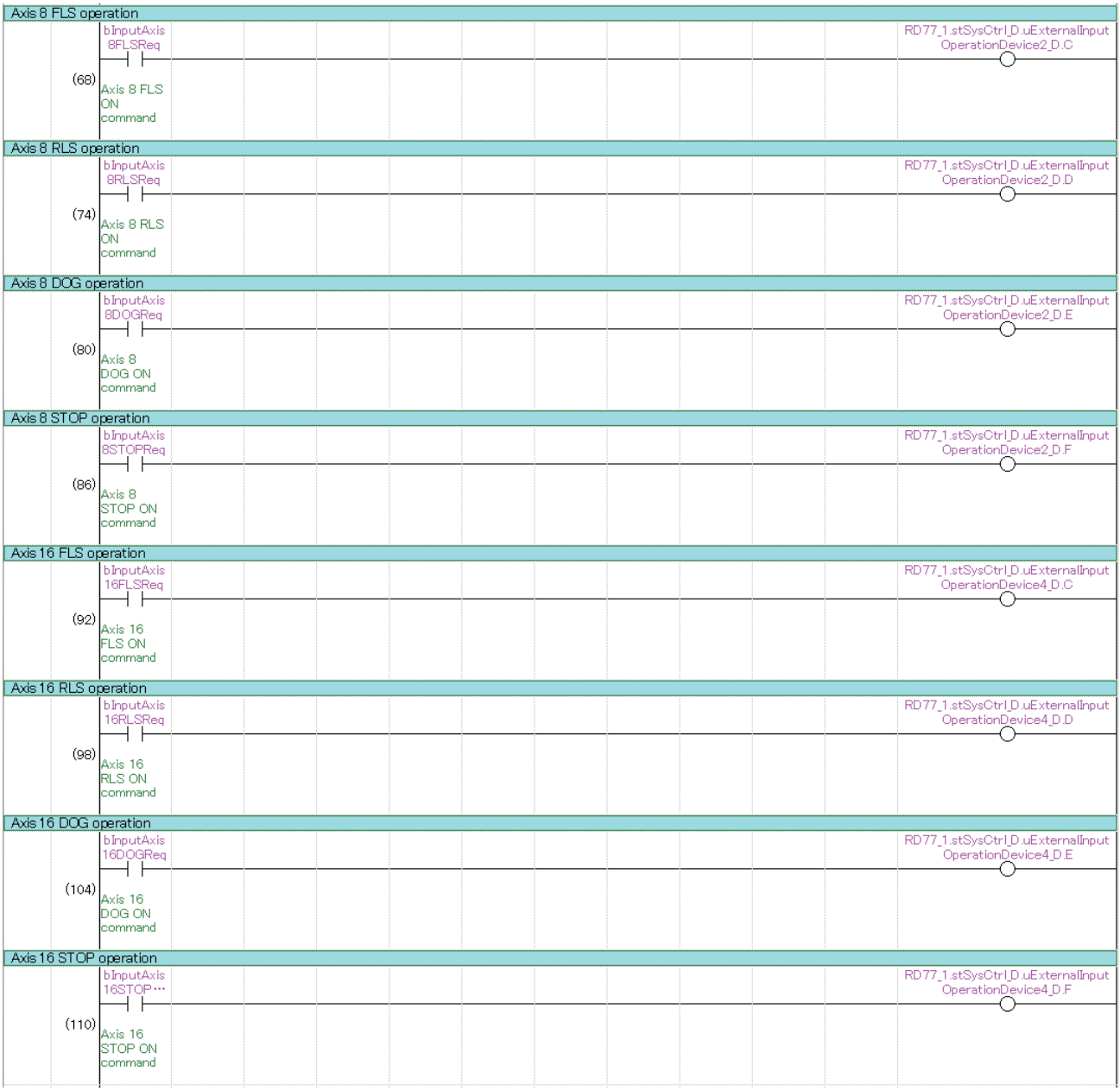
In the program examples, the labels to be used are assigned as follows.

| Classification | Label name | Description |
|---|---|---|
| Module label | RD77_1.stSysCtrl_D.uExternalInputOperationDevice1_D.0 | Axis 1 FLS |
| | RD77_1.stSysCtrl_D.uExternalInputOperationDevice1_D.1 | Axis 1 RLS |
| | RD77_1.stSysCtrl_D.uExternalInputOperationDevice1_D.2 | Axis 1 DOG |
| | RD77_1.stSysCtrl_D.uExternalInputOperationDevice1_D.3 | Axis 1 STOP |
| | RD77_1.stSysCtrl_D.uExternalInputOperationDevice1_D.C | Axis 4 FLS |
| | RD77_1.stSysCtrl_D.uExternalInputOperationDevice1_D.D | Axis 4 RLS |
| | RD77_1.stSysCtrl_D.uExternalInputOperationDevice1_D.E | Axis 4 DOG |
| | RD77_1.stSysCtrl_D.uExternalInputOperationDevice1_D.F | Axis 4 STOP |
| | RD77_1.stSysCtrl_D.uExternalInputOperationDevice2_D.C | Axis 8 FLS |
| | RD77_1.stSysCtrl_D.uExternalInputOperationDevice2_D.D | Axis 8 RLS |
| | RD77_1.stSysCtrl_D.uExternalInputOperationDevice2_D.E | Axis 8 DOG |
| | RD77_1.stSysCtrl_D.uExternalInputOperationDevice2_D.F | Axis 8 STOP |
| | RD77_1.stSysCtrl_D.uExternalInputOperationDevice4_D.C | Axis 16 FLS |
| | RD77_1.stSysCtrl_D.uExternalInputOperationDevice4_D.D | Axis 16 RLS |
| | RD77_1.stSysCtrl_D.uExternalInputOperationDevice4_D.E | Axis 16 DOG |
| | RD77_1.stSysCtrl_D.uExternalInputOperationDevice4_D.F | Axis 16 STOP |
| Global label | Defines the global labels to set the assignment device as follows. | |

| | Label Name | Data Type | | Class | Assign (Device/Label) |
|---|---|---|---|---|---|
| 1 | bInputAxis1FLSReq | Bit | ... | VAR_GLOBAL | X20 |
| 2 | bInputAxis1RLSReq | Bit | ... | VAR_GLOBAL | X21 |
| 3 | bInputAxis1DOGReq | Bit | ... | VAR_GLOBAL | X22 |
| 4 | bInputAxis1STOPReq | Bit | ... | VAR_GLOBAL | X23 |
| 5 | bInputAxis4FLSReq | Bit | ... | VAR_GLOBAL | X24 |
| 6 | bInputAxis4RLSReq | Bit | ... | VAR_GLOBAL | X25 |
| 7 | bInputAxis4DOGReq | Bit | ... | VAR_GLOBAL | X26 |
| 8 | bInputAxis4STOPReq | Bit | ... | VAR_GLOBAL | X27 |
| 9 | bInputAxis8FLSReq | Bit | ... | VAR_GLOBAL | X28 |
| 10 | bInputAxis8RLSReq | Bit | ... | VAR_GLOBAL | X29 |
| 11 | bInputAxis8DOGReq | Bit | ... | VAR_GLOBAL | X2A |
| 12 | bInputAxis8STOPReq | Bit | ... | VAR_GLOBAL | X2B |
| 13 | bInputAxis16FLSReq | Bit | ... | VAR_GLOBAL | X2C |
| 14 | bInputAxis16RLSReq | Bit | ... | VAR_GLOBAL | X2D |
| 15 | bInputAxis16DOGReq | Bit | ... | VAR_GLOBAL | X2E |
| 16 | bInputAxis16STOPReq | Bit | ... | VAR_GLOBAL | X2F |
| 17 | | | ... | | |

## ■Program example




Axis 8 FLS operation
bInputAxis 8FLSReq
RD77_1.stSysCtrl_D.uExternalInput OperationDevice2_D.C
(68)
Axis 8 FLS ON command
Axis 8 RLS operation
bInputAxis 8RLSReq
RD77_1.stSysCtrl_D.uExternalInput OperationDevice2_D.D
(74)
Axis 8 RLS ON command
Axis 8 DOG operation
bInputAxis 8DOGReq
RD77_1.stSysCtrl_D.uExternalInput OperationDevice2_D.E
(80)
Axis 8 DOG ON command
Axis 8 STOP operation
bInputAxis 8STOPReq
RD77_1.stSysCtrl_D.uExternalInput OperationDevice2_D.F
(86)
Axis 8 STOP ON command
Axis 16 FLS operation
bInputAxis 16FLSReq
RD77_1.stSysCtrl_D.uExternalInput OperationDevice4_D.C
(92)
Axis 16 FLS ON command
Axis 16 RLS operation
bInputAxis 16RLSReq
RD77_1.stSysCtrl_D.uExternalInput OperationDevice4_D.D
(98)
Axis 16 RLS ON command
Axis 16 DOG operation
bInputAxis 16DOGReq
RD77_1.stSysCtrl_D.uExternalInput OperationDevice4_D.E
(104)
Axis 16 DOG ON command
Axis 16 STOP operation
bInputAxis 16STOP…
RD77_1.stSysCtrl_D.uExternalInput OperationDevice4_D.F
(110)
Axis 16 STOP ON command

# 9.5 History Monitor Function

This function monitors start history and current value history stored in the buffer memory of the Simple Motion module on the operation monitor of an engineering tool.

## Start history

The start history logs of operations such as positioning operation, JOG operation, and manual pulse generator operation can be monitored. The latest 64 logs are stored all the time. This function allows users to check the operation sequence (whether the operations have been started in a predetermined sequence) at system start-up.
For the start history check method, refer to the "Simple Motion Module Setting Function Help" of an engineering tool.

**Point**

Set the clock of CPU module.
Refer to the following for setting method.
GX Works3 Operating Manual
There may be an error in tens of ms between the clock data of the CPU and the time data of the Simple Motion module.

## Current value history

The current value history data of each axis can be monitored. The following shows about the current value history data of each axis.

| Monitor details | Monitor item |
|---|---|
| Latest backup data<br>The number of backup: Once | Feed current value |
| | Servo command value |
| | Encoder single revolution position |
| | Encoder multiple revolution position |
| | Time 1 (Year: month)*1 |
| | Time 2 (Day: hour)*1 |
| | Time 3 (Minute: second)*1 |
| | Latest backup data pointer |
| Backup data at the power disconnection<br>The number of backup: 9 times | Feed current value |
| | Servo command value |
| | Encoder single revolution position |
| | Encoder multiple revolution position |
| | Time 1 (Year: month)*1 |
| | Time 2 (Day: hour)*1 |
| | Time 3 (Minute: second)*1 |
| | Backup data pointer |
| Backup data at the power on<br>The number of backup: 10 times | Feed current value |
| | Servo command value |
| | Encoder single revolution position |
| | Encoder multiple revolution position |
| | Time 1 (Year: month)*1 |
| | Time 2 (Day: hour)*1 |
| | Time 3 (Minute: second)*1 |
| | Error/warning code at current value restoration |

| Monitor details | Monitor item |
|---|---|
| Home position return data<br>The number of backup: Once | Feed current value |
| | Servo command value |
| | Encoder single revolution position |
| | Encoder multiple revolution position |
| | Time 1 (Year: month)*1 |
| | Time 2 (Day: hour)*1 |
| | Time 3 (Minute: second)*1 |

*1 Displays a value set by the clock function of the CPU module.

## ■Latest backup data

The latest backup data outputs the following data saved in the fixed cycle to the buffer memory.

- Feed current value
- Servo command value
- Encoder single revolution position
- Encoder multiple revolution position
- Time 1 (Year: month) data
- Time 2 (Day: hour) data
- Time 3 (Minute: second) data
- Latest backup data pointer

The latest backup data starts outputting the data after the power on.

After the home position is established in the absolute system, the data becomes valid and outputs the current value.

The following servo amplifier and servo motor are connected artificially during amplifier-less operation. Therefore, the encoder single revolution position and encoder multiple revolution position made virtually by the command value are output.

| [Pr.97] SSCNET setting | Servo amplifier type | Motor type |
|---|---|---|
| 1: SSCNETⅢ/H | MR-J4-10B | HG-KR053 (Resolution per servo motor rotation: 4194304 pulses) |
| 0: SSCNETⅢ | MR-J3-10B | HF-KP053 (Resolution per servo motor rotation: 262144 pulses) |

## ■Backup data at the power disconnection

The detail of the latest backup data right before the power disconnection is output to the buffer memory.

The backup data at the power disconnection starts being output after the power on.

The detail of the latest backup data right before the power disconnection used in the absolute system setting is output, regardless of the setting of the absolute system or incremental system.

If the data has never been used in the absolute system in the incremental system setting, "0" is output in all storage items.

## ■Backup data at the power on

After the power on, the detail of the data which restored the current value is output to the buffer memory.

The backup data at the power on starts being output after the power on.

If the current value cannot be restored in the absolute system, "0" is set to the feed current value and servo command value.

The warning "Home position return data incorrect" (warning code: 093CH) is set in the error/warning code at current value restoration.

When the incremental system is set, the detail of the backup data at the power on used in the absolute system setting is output. If the data has never been used in the absolute system, "0" is output in all storage items.

## ■Home position return data

The following data saved at home position return completion to the buffer memory.

- Feed current value at home position return completion
- Servo command value at home position return completion
- Encoder single revolution position of absolute position reference point data
- Encoder multiple revolution position of absolute position reference point data
- Time 1 (Year: month) data
- Time 2 (Day: hour) data
- Time 3 (Minute: second) data

The data becomes valid only when the absolute system is set.

If the data has never been used in the absolute system in the incremental system setting, "0" is output in all storage items.

# 9.6 Amplifier-less Operation Function



The positioning control of Simple Motion module without servo amplifiers connection can be executed in the amplifier-less function. This function is used to debug of user program or simulate of positioning operation at the start.

## Control details

Switch the mode from the normal operation mode (with servo amplifier connection) to the amplifier-less operation mode (without servo amplifier connection) to use the amplifier-less operation function.

Operation for each axis without servo amplifier connection as the normal operation mode can be executed during amplifier-less operation mode. The start method of positioning control is also the same procedure of normal operation mode.

The normal operation (with servo amplifier connection) is possible by switching from the amplifier-less operation mode to the normal operation mode after amplifier-less operation.

The current value management (current feed value, machine feed value) at the switching the normal operation mode and amplifier-less operation mode is shown below.

| "Absolute position detection system (PA03)" | Current value management at the operation mode switching | |
|---|---|---|
| | Normal operation mode → Amplifier-less operation mode | Amplifier-less operation mode → Normal operation mode |
| "0: Disabled" | The current feed value and machine feed value are "0". | The current feed value and machine feed value are "0". (At the communication start to the servo amplifiers) |
| "1: Enabled" | The amplifier-less operation mode starts with the address that the servo amplifier's power supply was finally turned OFF.<br>However, the home position is not established in the normal operation mode, the current feed value and machine feed value are "0". | The current feed value and machine feed value are restored according the actual position of servomotor. (At the communication start to the servo amplifiers)<br>However, when the home position is not established in the normal operation mode before switching to the amplifier-less operation mode, the current feed value and machine feed value are not restored. Execute the home position return.<br>When the mode is switched to the normal operation mode after moving that exceeds the range "-2147483648($-2^{31}$) to 2147483647($2^{31}$-1) [pulse]" from the actual position of servo motor during amplifier-less operation mode, the current feed value and machine feed value might be not restored correctly. |

### ■Point for control details

- Switch of the normal operation mode and amplifier-less operation mode is executed by the batch of all axes. Switch of the operation mode for each axis cannot be executed.
- Only axis that operated either the followings before switching to the amplifier-less operation mode becomes the connection status during amplifier-less operation.

  • "[Pr.100] Connected device" is set, and then the written to flash ROM is executed. (Turn the power supply ON or reset the CPU module after written to flash ROM.)
  • "[Pr.100] Connected device" is set, and then the PLC ready signal is turned ON.) (Servo amplifier connection is unnecessary.)

- Suppose the following servo amplifier and servo motor are connected during amplifier-less operation mode.

| [Pr.97] SSCNET setting | Servo amplifier type | Motor type |
|---|---|---|
| 1: SSCNETⅢ/H | MR-J4-10B | HG-KR053 (Resolution per servo motor rotation: 4194304 pulses) |
| 0: SSCNETⅢ | MR-J3-10B | HF-KP053 (Resolution per servo motor rotation: 262144 pulses) |

## Restrictions

• The following monitor data cannot be used during amplifier-less operation mode.

n: Axis No. - 1

| Storage item | | Storage details | Buffer memory address |
|---|---|---|---|
| [Md.102] | Deviation counter value | Always "0" during amplifier-less operation mode. | 2452+100n<br>2453+100n |
| [Md.105] | Connected device | As the following connected devices artificially during amplifier-less operation mode.<br>• When "1: SSCNETⅢ/H" is set in "[Pr.97] SSCNET setting"<br>00001000H: MR-J4-_B<br>• When "0: SSCNETⅢ" is set in "[Pr.97] SSCNET setting"<br>00000100H: MR-J3-_B | 58660<br>58661 |
| [Md.106] | Servo amplifier software No. | Always "0" during amplifier-less operation mode. | 2464+100n<br>⋮<br>2469+100n |
| [Md.107] | Parameter error No. | Always "0" during amplifier-less operation mode. | 2470+100n |
| [Md.108] | Servo status1 | As follows during amplifier-less operation mode.<br>• READY ON(b0), Servo ON(b1): Changed depending on the all axis servo ON signal[Y1] and "[Cd.100] Servo OFF command".<br>• Control mode (b2, b3): Indicates control mode.<br>• Servo alarm(b7): Always OFF<br>• In-position(b12): Always ON<br>• Torque limit(b13): Changed depending on "[Md.104] Motor current value". (Refer to the 2nd and 3rd bullets of restrictions for details.)<br>• Absolute position lost(b14): Always OFF<br>• Servo warning(b15): Always OFF | 2477+100n |
| [Md.109] | Regenerative load ratio/Optional data monitor output 1 | Always "0" during amplifier-less operation mode. | 2478+100n |
| [Md.110] | Effective load torque/Optional data monitor output 2 | Always "0" during amplifier-less operation mode. | 2479+100n |
| [Md.111] | Peak torque ratio/Optional data monitor output 3 | Always "0" during amplifier-less operation mode. | 2480+100n |
| [Md.112] | Optional data monitor output 4 | Always "0" during amplifier-less operation mode. | 2481+100n |
| [Md.119] | Servo status2 | As follows during amplifier-less operation mode.<br>• Zero point pass (b0): Always ON<br>• Zero speed (b3): Changed depending on the command speed<br>• Speed limit (b4): Always ON when the value other than "0" is set to the command torque at torque control mode. Otherwise, always OFF.<br>• PID control (b8): Always OFF | 2476+100n |

• The operation of following function differs from the normal operation mode during amplifier-less operation mode.

| Function | Operation |
|---|---|
| External signal selection function | When "1: Servo amplifier" is set in "[Pr.116] FLS signal selection", "[Pr.117] RLS signal selection", and "[Pr.118] DOG signal selection", the status of external signal at the amplifier-less operation mode start is shown below.<br>• Upper/lower limit signal (FLS, RLS): ON<br>• Near-point dog signal (DOG): OFF<br>Change "[Md.30] External input signal" to change the signal status. (Refer to the 3rd bullet of restrictions for details.)<br>When "2: Buffer memory" is set in "[Pr.116] FLS signal selection", "[Pr.117] RLS signal selection", and "[Pr.118] DOG signal selection", the upper/lower limit signal (FLS, RLS) and near-point dog signal (DOG) follow the buffer memory status of Simple Motion module during amplifier-less operation mode. |
| Torque limit function | Turns ON/OFF torque limit ("[Md.108] Servo status1": b13) depending on "[Md.104] Motor current value". (Refer to the 3rd bullet of restrictions for details.) |

• The operation of following monitor data differs from the normal operation mode during amplifier-less operation mode.

n: Axis No. - 1

| Storage item | | Storage details | Buffer memory address |
|---|---|---|---|
| [Md.30] | External input signal | When "1: Servo amplifier" is set in "[Pr.116] FLS signal selection", "[Pr.117] RLS signal selection", and "[Pr.118] DOG signal selection", the external input signal status can be operated by turning ON/OFF the "b0: Lower limit signal", "b1: Upper limit signal" or "b6: Near-point dog signal" during amplifier-less operation mode. | 2416+100n |
| [Md.104] | Motor current value | "0" is set at the amplifier-less operation mode start.<br>The motor current value can be emulated by changing this monitor data in user side during amplifier-less operation mode. | 2456+100n |

- When the power supply is turned OFF → ON or CPU module is reset during amplifier-less operation mode, the mode is switched to the normal operation mode.
- The operation of servo motor or the timing of operation cycle, etc. at the amplifier-less operation is different from the case where the servo amplifiers are connected at the normal operation mode. Confirm the operation finally with a real machine.
- The amplifier-less operation cannot be used in the test mode. Do not request to switch to the amplifier-less operation mode during test mode.
- The amplifier-less operation cannot be used in the fully closed loop system, linear servo or direct drive motor.
- Even if the PLC READY signal [Y0] is turned ON by changing "[Pr.100] Connected device" from "00000000H: Servo series is not set" to other than "0", the setting does not become valid. (The axis connecting status remains disconnection.)
- The operation cannot be changed to amplifier-less operation when connected and not connected servo amplifier axes are mixed. Change to amplifier-less operation when all axes are connected, or disconnect all axes of the servo amplifier.
- The synchronous encoder via servo amplifier cannot be used during amplifier-less operation mode.

## Data list

The data used in the amplifier-less operation function is shown below.

• System control data

| Setting item | | Setting value | Setting details | Buffer memory address |
|---|---|---|---|---|
| [Cd.137] | Amplifier-less operation mode switching request | → | Switch operation mode.<br>ABCDH: Switch from the normal operation mode to the amplifier-less operation mode.<br>0000H: Switch from the amplifier-less operation mode to the normal operation mode | 5926 |

• System monitor data

| Monitor item | | Monitor value | Storage details | Buffer memory address |
|---|---|---|---|---|
| [Md.51] | Amplifier-less operation mode status | → | Indicate the current operation mode.<br>0: Normal operation mode<br>1: Amplifier-less operation mode | 4232 |

## Operation mode switching procedure

• Switch from the normal operation mode to the amplifier-less operation mode

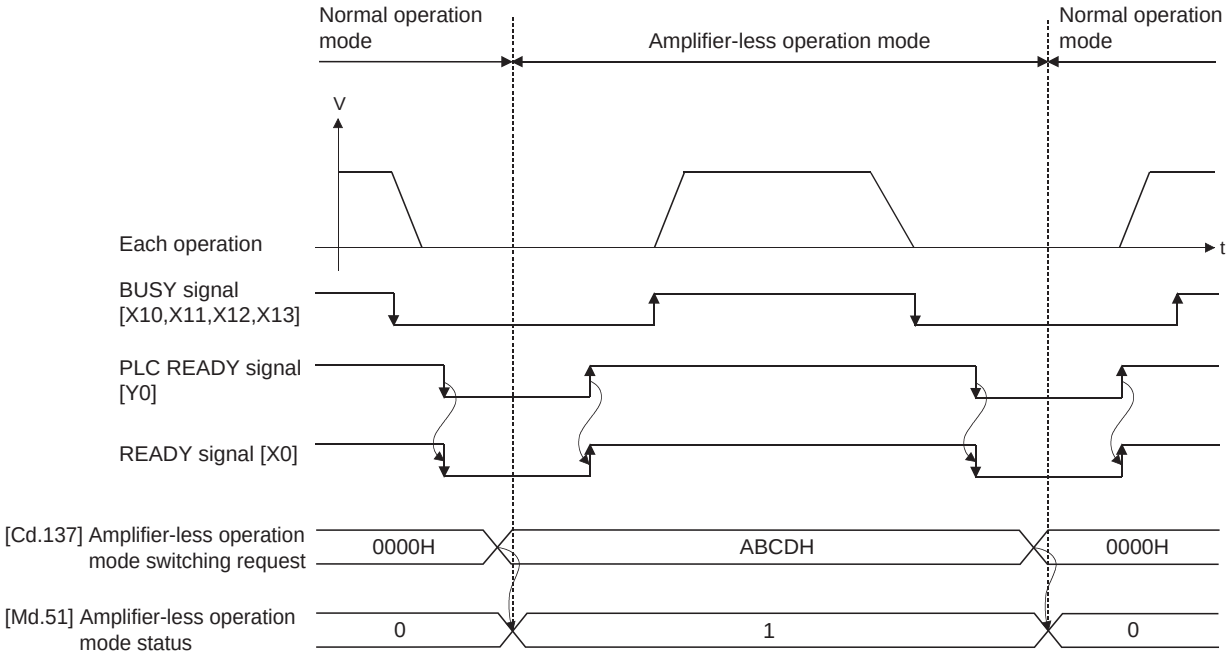
1. Stop all operating axes, and then confirm that the BUSY signal for all axes turned OFF.
2. Turn OFF the PLC READY signal [Y0].
3. Confirm that the READY signal [X0] turned OFF.
4. Set "ABCDH" in "[Cd.137] Amplifier-less operation mode switching request".
5. Confirm that "1: Amplifier-less operation mode" was set in "[Md.51] Amplifier-less operation mode status".

• Switch from the amplifier-less operation mode to the normal operation mode

1. Stop all operating axes, and then confirm that the BUSY signal for all axes turned OFF.
2. Turn OFF the PLC READY signal [Y0].
3. Confirm that the READY signal [X0] turned OFF.
4. Set "0000H" in "[Cd.137] Amplifier-less operation mode switching request".
5. Confirm that "0: Normal operation mode" was set in "[Md.51] Amplifier-less operation mode status".

• Operation chart

The following drawing shows the operation for the switching of the normal operation mode and amplifier-less operation mode [RD77MS4 operation example]




## ■Point for operation mode switching procedure

• Switch the "normal operation mode" and "amplifier-less operation mode" after confirming the all input signals except synchronization flag [X1] OFF. When switching the normal operation mode and amplifier-less operation mode in the status that any one of input signals except the synchronization flag [X1] is ON, the error "Error when switching from normal operation mode to amplifier-less operation mode" (error code: 18B0H) or "Error when switching from amplifier-less operation mode to normal operation mode" (error code: 18B1H) will occur, and the switching of operation mode will not execute.

• When the operation mode is switched with the servo amplifiers connected, the communication to the servo amplifiers is shown below.

- At switching from normal operation mode to amplifier-less operation mode: The communication for all axes during connection is disconnected. (The servo amplifier LED indicates "AA".)
- At switching from amplifier-less operation mode to normal operation mode: The communication to the servo amplifiers during connection is started.

• Even if the servo amplifiers are not connected, the switching of operation mode is possible.

• The forced stop is invalid regardless of the setting in "[Pr.82] Forced stop valid/invalid selection" during the amplifier-less operation mode.

• Only "0000H" and "ABCDH" are valid for the "[Cd.137] Amplifier-less operation mode switching request". The switching to amplifier-less operation mode can be accepted only when "[Cd.137] Amplifier-less operation mode switching request" is switched from "0000H" to "ABCDH". The switching to normal operation mode can be accepted only when "[Cd.137] Amplifier-less operation mode switching request" is switched from "ABCDH" to "0000H".

# 9.7 Virtual Servo Amplifier Function



This function is used to operate as virtual servo amplifier axis that generates only command virtually by setting "00000FFFH, 00001FFFH" in servo parameter "[Pr.100] Connected device". The synchronous control with virtually input command is possible by using the virtual servo amplifier axis as servo input axis of synchronous control. Also, it can be used as simulation operation for axes without servo amplifiers.

| Setting value of "[Pr.97] SSCNET setting" | Setting value of "[Pr.100] Connected device" |
|---|---|
| 0: SSCNETⅢ | 00000FFFH: MR-J3(W)-B (Virtual servo amplifier) |
| 1: SSCNETⅢ/H | 00001FFFH: MR-J4(W)-B(-RJ) (Virtual servo amplifier) |

## Control details

- When "00000FFFH, 00001FFFH" is set in "[Pr.100] Connected device" set in the flash ROM, it operates as virtual servo amplifier immediately after power supply ON.
- When "00000000H" is set in "[Pr.100] Connected device" set in the flash ROM, it operates as virtual servo amplifier by setting "00000FFFH, 00001FFFH" in "[Pr.100] Connected device" of buffer memory and by turning the PLC READY signal [Y0] OFF to ON after power supply ON.
- Do not connect the actual servo amplifier to axis set as virtual servo amplifier. If the servo amplifier is connected, the LED display status remains "Ab." and the servo amplifier is not recognized. The following servo amplifiers cannot be connected until the end station.
- The current feed value and machine feed value of virtual servo amplifier are as follows.

  - When "0: Disabled (incremental system)" is set in "Absolute position detection system (PA03)", the both of current feed value and machine feed value are set to "0".
  - When "1: Enabled (absolute position detection system)" is set in "Absolute position detection system (PA03)", the address at the latest power supply OFF is set if the home position has been established. If the home position has not been established, the both of current feed value and machine feed value are set to "0".

- When the virtual servo amplifier is set in the system setting of the engineering tool, "0: Disabled (incremental system)" is set in "Absolute position detection system (PA03)". Set "1: Enabled (absolute position detection system)" to the buffer memory to use as absolute position system.

**Point**

Do not make to operate by switching between the actual servo amplifier and virtual servo amplifier. When a value except "00000000H" is set in "[Pr.100] Connected device" set in the flash ROM, the connected device is not changed even if the "[Pr.100] Connected device" of buffer memory is changed after power supply ON and then the PLC READY signal [Y0] is turned OFF to ON. To change the connected device, write to the flash ROM and turn the power ON again or reset the CPU module.

## Restrictions

• The following monitor data of virtual servo amplifier differ from the actual servo amplifier.

n: Axis No. - 1

| Storage item | | Storage details | Buffer memory address |
|---|---|---|---|
| [Md.102] | Deviation counter value | Always "0". | 2452+100n<br>2453+100n |
| [Md.105] | Connected device | As the following connected devices artificially.<br>• When "1: SSCNETⅢ/H" is set in "[Pr.97] SSCNET setting"<br>00001000H: MR-J4-_B<br>• When "0: SSCNETⅢ" is set in "[Pr.97] SSCNET setting"<br>00000100H: MR-J3-_B | 58660<br>58661 |
| [Md.106] | Servo amplifier software No. | Always "0". | 2464+100n<br>to<br>2469+100n |
| [Md.107] | Parameter error No. | Always "0". | 2470+100n |
| [Md.108] | Servo status1 | • READY ON (b0), Servo ON (b1): Changed depending on the all axis servo ON signal [Y1] and "[Cd.100] Servo OFF command"<br>• Control mode (b2, b3): Indicates control mode.<br>• Servo alarm (b7): Always OFF<br>• In-position (b12): Always ON<br>• Torque limit (b13): Changed depending on "[Md.104] Motor current value". (Refer to the 2nd and 3rd bullets of restrictions for details.)<br>• Absolute position lost (b14): Always OFF<br>• Servo warning (b15): Always OFF | 2477+100n |
| [Md.109] | Regenerative load ratio/Optional data monitor output 1 | Always "0". | 2478+100n |
| [Md.110] | Effective load torque/Optional data monitor output 2 | Always "0". | 2479+100n |
| [Md.111] | Peak torque ratio/Optional data monitor output 3 | Always "0". | 2480+100n |
| [Md.112] | Optional data monitor output 4 | Always "0". | 2481+100n |
| [Md.119] | Servo status2 | • Zero point pass (b0): Always ON<br>• Zero speed (b3): Changed depending on the command speed<br>• Speed limit (b4): Always ON when the value other than "0" is set to the command torque at torque control mode. Otherwise, always OFF.<br>• PID control (b8): Always OFF | 2476+100n |

• The operation for external signal selection function of virtual servo amplifier differs from the actual servo amplifier.

| Function | Operation |
|---|---|
| External signal selection function | When "1: Servo amplifier" is set in "[Pr.116] FLS signal selection", "[Pr.117] RLS signal selection", and "[Pr.118] DOG signal selection", the external signal status immediately after the power supply ON is shown below.<br>• Upper/lower limit signal (FLS, RLS): ON<br>• Near-point dog signal (DOG): OFF<br>Change the signal status in "[Md.30] External input signal". (Refer to the 3rd bullet of restrictions for details.) |
| Torque limit function | Turns ON/OFF torque limit ("[Md.108] Servo status1": b13) depending on "[Md.104] Motor current value". (Refer to the 3rd bullet of restrictions for details.) |

• The following monitor data of virtual servo amplifier differ from the actual servo amplifiers. The writing operation is possible in the virtual servo amplifier.

n: Axis No. - 1

| Storage item | | Storage details | Buffer memory address |
|---|---|---|---|
| [Md.30] | External input signal | When "1: Servo amplifier" is set in "[Pr.116] FLS signal selection", "[Pr.117] RLS signal selection", and "[Pr.118] DOG signal selection", the external input signal status can be operated by turning ON/OFF the following signals.<br>• b0: Lower limit signal<br>• b1: Upper limit signal<br>• b6: Near-point dog signal | 2416+100n |
| [Md.104] | Motor current value | "0" is set after immediately power supply ON.<br>The motor current value can be emulated by changing this monitor data in user side. | 2456+100n |

# 9.8 Driver Communication Function



This function uses the "Master-slave operation function" of servo amplifier. The Simple Motion module controls master axis and the slave axis is controlled by data communication between servo amplifiers (driver communication) without Simple Motion module.

There are restrictions in the function that can be used by the version of servo amplifier. Refer to each servo amplifier instruction manual for details.

The following shows the number of settable axes for the master axis and slave axis.

| Network | Servo amplifier | Module | Combination of number of settable axes | | Remark |
|---|---|---|---|---|---|
| | | | Master axis | Slave axis | |
| SSCNETⅢ | MR-J3-_B<br>MR-J3-_BS<br>MR-J3-_B-RJ006*1 | RD77MS2 | 1 axis | 1 axis or more per master axis | The axes other than the master axis and slave axis can be used as normal axis. |
| | | RD77MS4 | 1 axis to 2 axes | | |
| | | RD77MS8 | 1 axis to 4 axes | | |
| | | RD77MS16 | 1 axis to 4 axes | | |
| SSCNETⅢ/H | MR-J4-_B*2 | RD77MS2 | 1 axis | 1 axis or more per master axis | |
| | | RD77MS4 | 1 axis to 2 axes | | |
| | | RD77MS8 | 1 axis to 4 axes | | |
| | | RD77MS16 | 1 axis to 8 axes | | |

*1 The fully closed loop control servo amplifier can be set for the master axis only. It cannot be set for the slave axis.

*2 In the fully closed loop system, the servo amplifier can be set for the master axis only. It cannot be set for the slave axis. Also, it cannot be used with the linear servo motors or direct drive motors. Refer to each servo amplifier instruction manual for details.

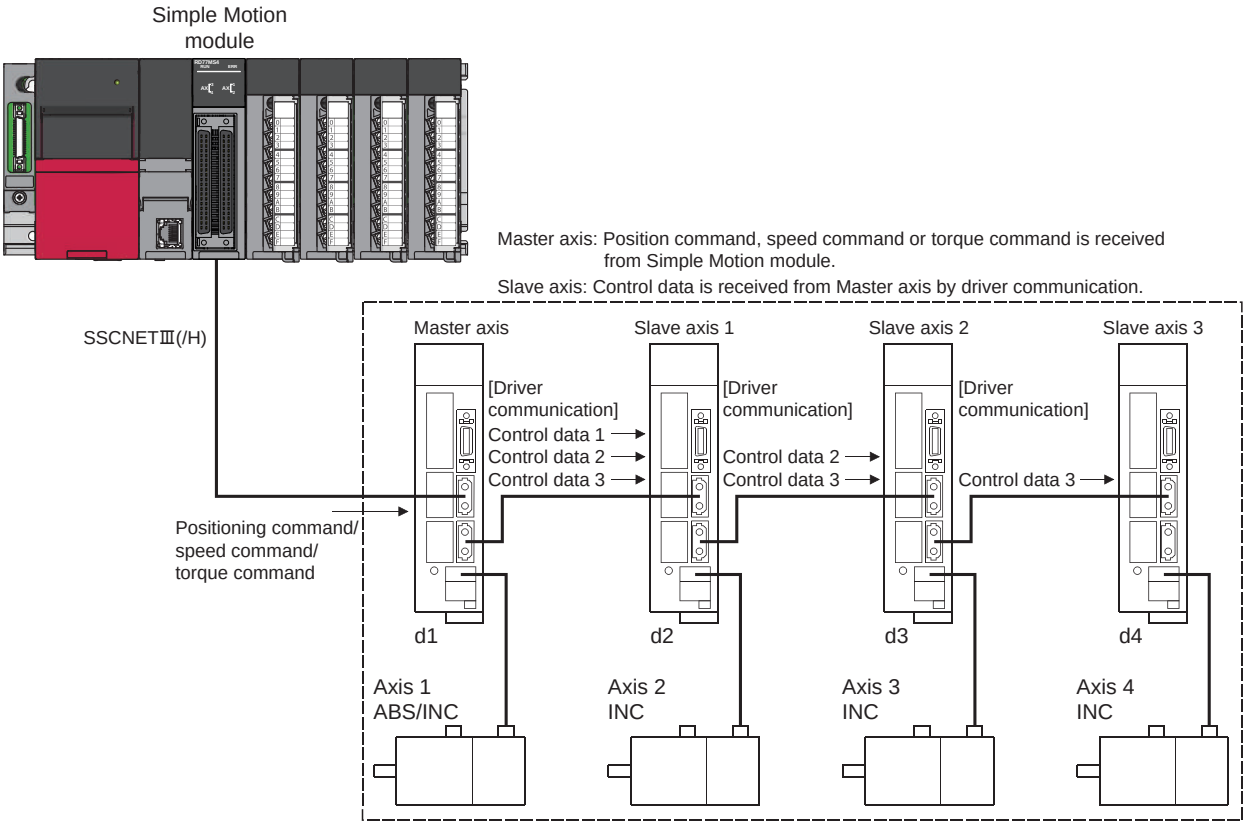
## Control details

Set the master axis and slave axis in the servo parameter.

Execute each control of Simple Motion module for the master axis. (However, be sure to execute the servo ON/OFF of slave axis and error reset at servo error occurrence in the slave axis.)

The servo amplifier set as master axis receives command (positioning command, speed command, torque command) from the Simple Motion module, and send the control data to the servo amplifier set as slave axis by driver communication between servo amplifiers.

The servo amplifier set as the slave axis is controlled with the control data transmitted from master axis by driver communication between servo amplifiers.




**Point**

- When the communication is disconnected due to a fault in the servo amplifier, it is not possible to communicate with the axis after the faulty axis. Therefore, when connecting the SSCNETⅢ cable, connect the master axis in the closest position to the Simple Motion module.
- This function is used for the case to operate by multiple motors in one system. Connect the master axis and slave axis without slip.

## Precautions during control

### ⚠CAUTION

- In the operation by driver communication, the positioning control or JOG operation of the master axis is not interrupted even if the servo error occurs in the slave axis. Be sure to stop by user program.

## ■Servo amplifier

- Use the servo amplifiers compatible with the driver communication for the axis to execute the driver communication.
- The combination of the master axis and slave axis is set in the servo parameters. The setting is valid by turning ON or resetting the system's power supply after writing the servo parameters to the Simple Motion module.
- Check the operation enabled status of driver communication in "[Md.52] Communication between amplifiers axes searching flag". The operation cannot be changed to amplifier-less operation when connected and not connected servo amplifier axes are mixed. Change to amplifier-less operation when all axes are connected, or disconnect all axes of the servo amplifier.
- When connecting/disconnecting at driver communication function use, it can be executed only for the head axis (servo amplifier connected directly to the Simple Motion module). The servo amplifier other than the head axis can be disconnected, however it cannot be connected again.
- Differences between SSCNETⅢ connection and SSCNETⅢ/H connection in driver communication function are shown below.

| Item | SSCNETⅢ | SSCNETⅢ/H |
|---|---|---|
| Communication with the servo amplifiers after controller's power supply ON | The servo amplifiers cannot be operated until the connection with all system setting axes is confirmed. | The servo amplifiers cannot be operated until the connection with all driver communication setting axes is confirmed. The normal operation axis (driver communication unset up axis) can be connected after the network is established. |
| Connect/disconnect with servo amplifier | Only the first axis (servo amplifier connected directly to the Simple Motion module) can connect/disconnect. Servo amplifiers other than the first axis can be disconnected but cannot be connected. | Only the first axis (servo amplifier connected directly to the Simple Motion module) can connect/disconnect. Only normal axes (axes not set to driver communication) other than the first axis can be connected when they are disconnected. However, when axes set to driver communication are disconnected, they cannot communicate with servo amplifiers that were connected after disconnecting. (The servo amplifier's LED display remains "AA".) |

- If all axes set to driver communication are not detected at the start of communication with the servo amplifier, all axes including independent axes cannot be operated. (The servo amplifier's LED display remains "Ab".) Check the operation enabled status with "[Md.52] Communication between amplifiers axes searching flag". When all independent axes and axes set to driver communication are connected, "0: Search end" is set in "[Md.52] Communication between amplifiers axes searching flag".

| Monitor item | | Monitor value | Storage details | Buffer memory address |
|---|---|---|---|---|
| [Md.52] | Communication between amplifiers axes searching flag | → | The detection status of axis that set communication between amplifiers is stored.<br>0: Search end<br>1: Searching | 4234 |

## ■Home position return control, positioning control, manual control, expansion control, and synchronous control

- Do not start the slave axis. The command to servo amplifier is invalid even if the slave axis is started.
- The home position return request flag ([Md.31] Status: b3) of slave axis is always ON. There is no influence for control of slave axis.
- There are some restrictions for data used as the positioning control of slave axis. The external input signals such as FLS or RLS, and the parameters such as software stroke limit are invalid. Refer to ☞ Page 328 I/O signals of slave axis and ☞ Page 328 Data used for positioning control of slave axis for details.
- For setting the slave axis as a servo input axis, set "2: Real current value" or "4: Feedback value" in "[Pr.300] Servo input axis type". Otherwise, the slave axis does not operate as an input axis.
- At the driver communication operation, only the switching to positioning control mode, speed control mode, and torque control mode are possible. When the mode is switched to continuous operation to torque control mode for the master axis, the warning "Control mode switching not possible" (warning code: 09EBH) will occur, and the control mode is not switched.

## ■Absolute position system

Set "0: Disabled (incremental system)" in "Absolute position detection system (PA03)" of servo parameter for slave axis. If "1: Enabled (absolute position detection system)" is set, the warning "Home position return data incorrect" (warning code: 093CH) will occur and the home position return of slave axis cannot be executed.

## ■I/O signals of slave axis

- Input signal: All signals cannot be used. The error detection signal turns ON "Error detection" ([Md.31] Status: b13).
- Output signal: All signals cannot be used.

## ■Data used for positioning control of slave axis

- Only the following axis monitor data are valid in slave axis.

| Item | | Remark |
|---|---|---|
| [Md.23] | Axis error No. | Valid for only servo error detection. |
| [Md.35] | Torque limit stored value/forward torque limit stored value | — |
| [Md.102] | Deviation counter value | — |
| [Md.103] | Motor rotation speed | — |
| [Md.104] | Motor current value | — |
| [Md.107] | Parameter error No. | — |
| [Md.108] | Servo status1 | The following bits are valid.<br>• b0: READY ON<br>• b1: Servo ON<br>• b7: Servo alarm<br>*: The slave axis is always controlled in torque control mode, "control mode (b2, b3)" is set to torque control mode (0, 1). |
| [Md.109] | Regenerative load ratio/Optional data monitor output 1 | — |
| [Md.110] | Effective load torque/Optional data monitor output 2 | — |
| [Md.111] | Peak torque ratio/Optional data monitor output 3 | — |
| [Md.112] | Optional data monitor output 4 | — |
| [Md.114] | Servo alarm | — |
| [Md.119] | Servo status2 | The following bit is valid.<br>• b0: Zero point pass<br>(Execute home position return to the master axis.) |
| [Md.120] | Reverse torque limit stored value | — |

- Only the following axis control data are valid in slave axis.

| Item | | Remark |
|---|---|---|
| [Cd.5] | Axis error reset | Reset is valid for only servo error detection. |
| [Cd.22] | New torque value/forward new torque value | — |
| [Cd.100] | Servo OFF command | — |
| [Cd.101] | Torque output setting value | — |
| [Cd.112] | Torque change function switching request | — |
| [Cd.113] | Reverse new torque value | — |

## Servo parameter

Set the following parameters for the axis to execute the driver communication. (Refer to each servo amplifier instruction manual for details.)

[MR-J3-_B/MR-J3-_BS/MR-J3-_B-RJ006 use]

n: Axis No. - 1

| Setting item | | | Setting details | Buffer memory address |
|---|---|---|---|---|
| Input/output setting | PA04 | Forced stop deceleration function selection | Disable deceleration stop function at the master axis and slave axis.*2 | 28404+100n |
| | PD15 | Driver communication setting | Set the master axis and slave axis. | 65534+340n |
| | PD16 | Driver communication setting<br>Master transmit data selection 1 | Set the transmitted data at master axis setting. | 65535+340n |
| | PD17 | Driver communication setting<br>Master transmit data selection 2 | | 65536+340n |
| | PD20 | Driver communication setting<br>Master axis No. selection 1 for slave | Set the axis No. of master axis at slave axis setting. | 65539+340n |
| | PD30 | Master-slave operation<br>Torque command coefficient on slave | Set the parameter at slave axis setting. | 65549+340n |
| | PD31 | Master-slave operation<br>Speed limit coefficient on slave | | 65550+340n |
| | PD32 | Master-slave operation<br>Speed limit adjusted value on slave | | 65551+340n |

*1 When the slave axis is not allocated for the master axis, only the master axis operates independently.

*2 At MR-J3-_B/MR-J3-_B-RJ006 use, it is not necessary to change the setting since the initial value is disabled. However, it is required to set disabled since the initial value is enabled at MR-J3-_BS use.

**Point**

- The servo parameters are transmitted from Simple Motion module to servo amplifier after power supply ON or reset of the CPU module. Execute flash ROM writing of Simple Motion module after writing the servo parameter to buffer memory, and then turn the power supply ON or reset the CPU module.
- The servo parameters for driver communication setting (PD15 to PD17, PD20) become valid by turning the servo amplifier's power supply OFF to ON. Turn the servo amplifier's power supply OFF to ON after executing the above shown in the 1st bullet. Then, turn the system's power supply ON again or reset the CPU module.
- In the driver communication function, the torque generation direction for slave axis can be set in "Rotation direction selection/travel direction selection (PA14)".

[MR-J4-_B use]

n: Axis No. - 1

| Setting item | | | Setting details | Buffer memory address |
|---|---|---|---|---|
| Input/output setting | PA04 | Forced stop deceleration function selection | Disable deceleration stop function at the master axis and slave axis. | 28404+100n |
| | PD15 | Driver communication setting | Set the master axis and slave axis. | 65534+340n |
| | PD16 | Driver communication setting<br>Master transmit data selection 1 | Set the transmitted data at master axis setting. | 65535+340n |
| | PD17 | Driver communication setting<br>Master transmit data selection 2 | | 65536+340n |
| | PD20 | Driver communication setting<br>Master axis No. selection 1 for slave | Set the axis No. of master axis at slave axis setting. | 65539+340n |
| | PD30 | Master-slave operation<br>Torque command coefficient on slave | Set the parameter at slave axis setting. | 65549+340n |
| | PD31 | Master-slave operation<br>Speed limit coefficient on slave | | 65550+340n |
| | PD32 | Master-slave operation<br>Speed limit adjusted value on slave | | 65551+340n |

*1 When the slave axis is not allocated for the master axis, only the master axis operates independently.

*2 At slave setting, set only "Driver communication setting Master axis No. selection 1 for slave (PD20)" in the master axis No. selection normally.

**Point**

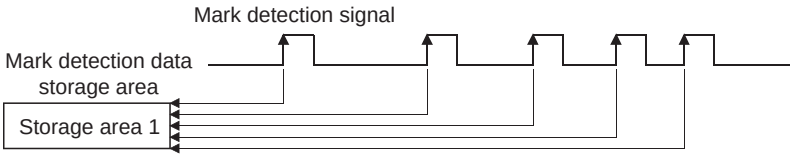
- The servo parameters are transmitted from Simple Motion module to servo amplifier after power supply ON or reset of the CPU module. Execute flash ROM writing of Simple Motion module after writing the servo parameter to buffer memory, and then turn the power supply ON or reset the CPU module.
- The servo parameters for driver communication setting (PA04, PD15 to PD17, PD20) become valid by turning the servo amplifier's power supply OFF to ON. Turn the servo amplifier's power supply OFF to ON after executing the above shown in the 1st bullet. Then, turn the system's power supply ON again or reset the CPU module.
- In the driver communication function, the torque generation direction for slave axis can be set in "Rotation direction selection/travel direction selection (PA14)".

# 9.9 Mark Detection Function

Any data can be latched at the input timing of the mark detection signal (DI).
Also, only data within a specific range can be latched by specifying the data detection range.
The following three modes are available for execution of mark detection.

## Continuous detection mode

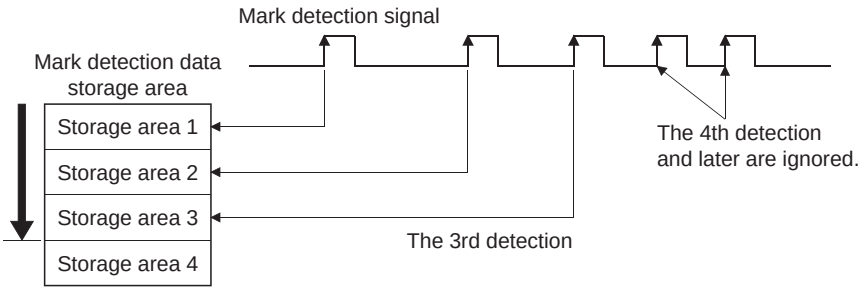
The latched data is always stored to the first of mark detection data storage area at mark detection.




## Specified number of detections mode

The latched data from a specified number of detections is stored.
The detected position for a specified number of detections can be collected when the mark detection signal is continuously input at high speed.

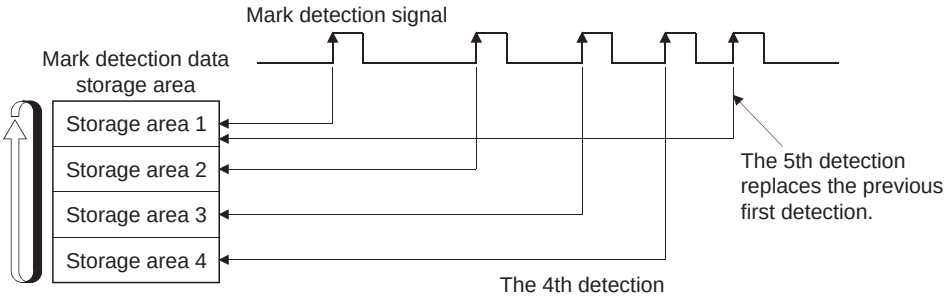
Ex.
Number of detections: 3




## Ring buffer mode

The latched data is stored in a ring buffer for a specified number of detections.
The latched data is always stored at mark detection.

Ex.
Number of detections: 4



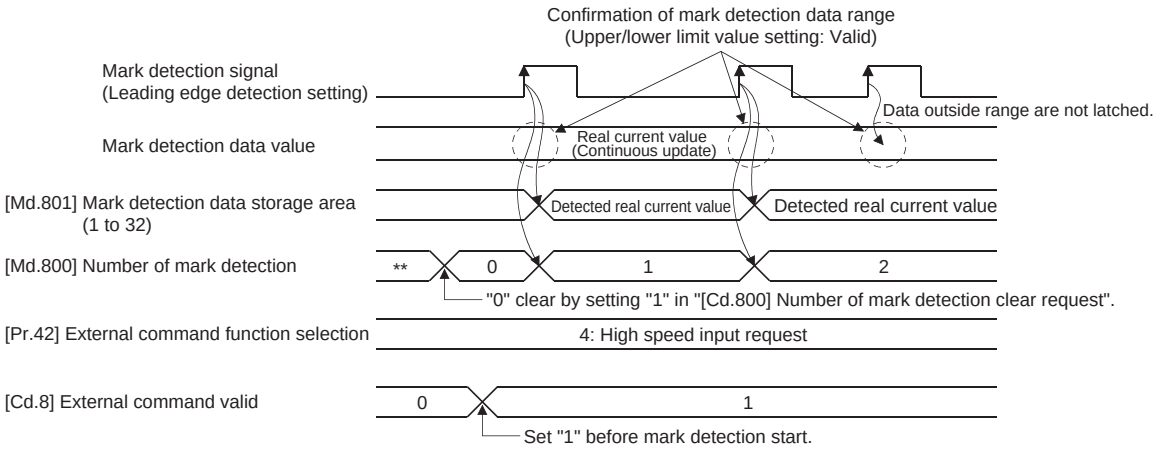
| Item | Performance specifications | | | |
|---|---|---|---|---|
| | RD77MS2 | RD77MS4 | RD77MS8 | RD77MS16 |
| Number of mark detection settings | Up to 16 | | | |
| Input signal | External input signal (DI1 to DI10) | External input signal (DI1 to DI20) | | |
| Input signal detection direction | Selectable for leading edge or trailing edge in logic setting of external input signal | | | |
| Input signal compensation time | Correctable within the range of -32768 to 32767 μs | | | |
| Detection accuracy | 10 μs | | | |
| Latch data | 11 types + Optional buffer memory data (2 words)<br>(Current feed value, Machine feed value, Real current value, Servo input axis current value, Synchronous encoder axis current value, Synchronous encoder axis current value per cycle, Current value after composite main shaft gear, Current value per cycle after main shaft gear, Current value per cycle after auxiliary shaft gear, Cam axis current value per cycle, Cam axis current value per cycle (real position) ) | | | |
| Number of continuous latch data storage | Up to 32 | | | |
| Latched data range | Settable in the range of -2147483648 to 2147483647 | | | |

## Operation for mark detection function

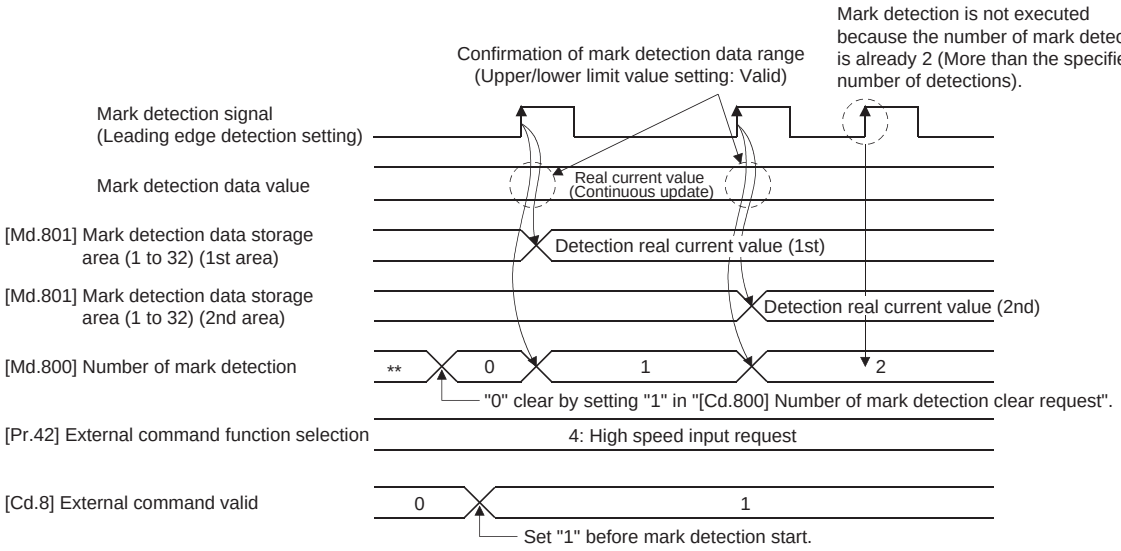
Operations done at mark detection are shown below.

- Calculations for the mark detection data are estimated at leading edge/trailing edge of the mark detection signal. However, when the specified number of detections mode is set, the current number of mark detection is checked, and then it is judged whether to execute the mark detection.
- When a mark detection data range is set, it is first confirmed whether the mark detection data is within the range or not. Data outside the range are not detected.
- The mark detection data is stored in the mark detection data storage area according to the mark detection mode, and then the number of mark detection is updated.

### ■Continuous detection mode



### ■Specified number of detection mode (Number of detections: 2)


Mark detection is not executed because the number of mark detections is already 2 (More than the specified number of detections).
Confirmation of mark detection data range (Upper/lower limit value setting: Valid)
Mark detection signal (Leading edge detection setting)
Mark detection data value
Real current value (Continuous update)
[Md.801] Mark detection data storage area (1 to 32) (1st area)
Detection real current value (1st)
[Md.801] Mark detection data storage area (1 to 32) (2nd area)
Detection real current value (2nd)
[Md.800] Number of mark detection
**
0
1
2
"0" clear by setting "1" in "[Cd.800] Number of mark detection clear request".
[Pr.42] External command function selection
4: High speed input request
[Cd.8] External command valid
0
1
Set "1" before mark detection start.

## How to use mark detection function

The following shows an example for mark detection by the external command signal (DI2) of axis 2.

The mark detection target is axis 1 real current value, and the all range is detected in continuous detection mode.

- Allocate the input signal (DI2) to the external command signal of axis 2, and set the "high speed input request" for mark detection.

n: Axis No. - 1

| Storage item | | Setting value | Storage details/storage value | Buffer memory address |
|---|---|---|---|---|
| [Pr.95] | External command signal selection | 2 | Set "2: DI2" to the external command signal of axis 2. | 219 (69+150n) |
| [Pr.42] | External command function selection | 4 | Set "4: High speed input request" as the function used in the external command signal of axis 2. | 212 (62+150n) |

- Set the following mark detection setting parameters. The optional mark detection setting No. can be set.

k: Mark detection setting No. - 1

| Storage item | | Setting value | Storage details/storage value | Buffer memory address |
|---|---|---|---|---|
| [Pr.800] | Mark detection signal setting | 2 | Set "2: Axis 2" to the external input signal for mark detection. | 54000+20k |
| [Pr.801] | Mark detection signal compensation time | 0 | Set "0: (No compensation)" to the compensation time such as delay of sensor. | 54001+20k |
| [Pr.802] | Mark detection data type | 2 | Set "2: Real current value" to the target data for mark detection. | 54002+20k |
| [Pr.803] | Mark detection data axis No. | 1 | Set "1: Axis 1" to the axis No. of target data for mark detection. | 54003+20k |
| [Pr.805] | Latch data range upper limit value | 0 | Set "0" to the valid upper limit value for latch data at mark detection. (Mark detection for all range is executed by setting the same value as lower limit value.) | 54006+20k<br>54007+20k |
| [Pr.806] | Latch data range lower limit value | 0 | Set "0" to the valid lower limit value for latch data at mark detection. (Mark detection for all range is executed by setting the same value as upper limit value.) | 54008+20k<br>54009+20k |
| [Pr.807] | Mark detection mode setting | 0 | Set "0: Continuous detection mode" to the mark detection mode. | 54010+20k |

- Turn the power supply OFF or reset of the CPU module to validate the setting parameters.
- The mark detection starts by setting "1: Validates an external command." in "[Cd.8] External command valid" of axis 2 with the program. Refer to "[Md.800] Number of mark detection" or "[Md.801] Mark detection data storage area (1 to 32)" of the set detection setting No. for the number of mark detections and mark detection data.

## List of parameters and data

The following shows the configuration of parameters and data for mark detection function.

| Buffer memory address | Item | Mark detection setting No. |
|---|---|---|
| 54000 to 54019 | Mark detection setting parameter [Pr.800] to [Pr.807] | Mark detection setting 1 |
| 54020 to 54039 | | Mark detection setting 2 |
| 54040 to 54059 | | Mark detection setting 3 |
| ⋮ | | ⋮ |
| 54300 to 54319 | | Mark detection setting 16 |
| 54640 to 54649 | Mark detection control data [Cd.800], [Cd.801], [Cd.802] | Mark detection setting 1 |
| 54650 to 54659 | | Mark detection setting 2 |
| 54660 to 54669 | | Mark detection setting 3 |
| ⋮ | | ⋮ |
| 54790 to 54799 | | Mark detection setting 16 |
| 54960 to 55039 | Mark detection monitor data [Md.800], [Md.801] | Mark detection setting 1 |
| 55040 to 55119 | | Mark detection setting 2 |
| 55120 to 55199 | | Mark detection setting 3 |
| ⋮ | | ⋮ |
| 56160 to 56239 | | Mark detection setting 16 |

The following shows the parameters and data used in the mark detection function.

## Mark detection setting parameters

k: Mark detection setting No. - 1

| Setting item | | Setting details/setting value | Default value | Buffer memory address |
|---|---|---|---|---|
| [Pr.800] | Mark detection signal setting | Set the external input signal (high speed input request) for mark detection.<br>0: Invalid<br>1 to 2: External command signal of axis 1 to axis 2 (RD77MS2)<br>1 to 4: External command signal of axis 1 to axis 4 (RD77MS4)<br>1 to 8: External command signal of axis 1 to axis 8 (RD77MS8)<br>1 to 16: External command signal of axis 1 to axis 16 (RD77MS16)<br>Fetch cycle: Power supply ON | 0 | 54000+20k |
| [Pr.801] | Mark detection signal compensation time | Set the compensation time such as delay of sensor.<br>Set a positive value to compensate for a delay.<br>-32768 to 32767 [μs]<br>Fetch cycle: Power supply ON or PLC READY signal [Y0] OFF to ON | 0 | 54001+20k |
| [Pr.802] | Mark detection data type | Set the target data for mark detection.<br>0 to 12: Data type<br>-1: Optional 2 word buffer memory<br>Fetch cycle: Power supply ON | 0 | 54002+20k |
| [Pr.803] | Mark detection data axis No. | Set the axis No. of target data for mark detection.<br>1 to 2: Axis 1 to Axis 2 (RD77MS2)<br>1 to 4: Axis 1 to Axis 4 (RD77MS4)<br>1 to 8: Axis 1 to Axis 8 (RD77MS8)<br>1 to 16: Axis 1 to Axis 16 (RD77MS16)<br>801 to 804: Synchronous encoder Axis 1 to 4<br>Fetch cycle: Power supply ON | 0 | 54003+20k |
| [Pr.804] | Mark detection data buffer memory No. | Set the optional buffer memory No.<br>Set this parameter as an even number.<br>0 to 98302: Optional buffer memory<br>Fetch cycle: Power supply ON | 0 | 54004+20k<br>54005+20k |
| [Pr.805] | Latch data range upper limit value | Set the valid upper limit value for latch data at mark detection.<br>-2147483648 to 2147483647<br>Fetch cycle: Power supply ON, PLC READY signal [Y0] OFF to ON, or latch data range change request | 0 | 54006+20k<br>54007+20k |
| [Pr.806] | Latch data range lower limit value | Set the valid lower limit value for latch data at mark detection<br>-2147483648 to 2147483647<br>Fetch cycle: Power supply ON, PLC READY signal [Y0] OFF to ON, or latch data range change request | 0 | 54008+20k<br>54009+20k |
| [Pr.807] | Mark detection mode setting | Set the continuous detection mode or specified number of detection mode.<br>0: Continuous detection mode<br>1 to 32: Specified number of detection mode (Set the number of detections.)<br>-1 to -32: Ring buffer mode (Set the value that made the number of buffers into negative value.)<br>Fetch cycle: Power supply ON or PLC READY signal [Y0] OFF to ON | 0 | 54010+20k |

**Point**

The above parameters are valid with the value set in the flash ROM of the Simple Motion module when the power ON or the CPU module reset. Except for a part, the value is not fetched by turning the PLC READY signal ON from OFF. Therefore, write to the flash ROM after setting the value in the buffer memory to change.

## [Pr.800] Mark detection signal setting

Set the input signal for mark detection.

| Setting value | Setting details |
|---|---|
| 0 | Invalid |
| 1 to 2 | External command signal (DI) of axis 1 to axis 2 (RD77MS2) |
| 1 to 4 | External command signal (DI) of axis 1 to axis 4 (RD77MS4) |
| 1 to 8 | External command signal (DI) of axis 1 to axis 8 (RD77MS8) |
| 1 to 16 | External command signal (DI) of axis 1 to axis 16 (RD77MS16) |

If a value other than the above is set, the warning "Outside mark detection signal setting range" (warning code: 0936H) occurs and the target mark detection is not available.

Set "4: High speed input request" in "[Pr.42] External command function selection" and set "1: Validates an external command." in "[Cd.8] External command valid".

## [Pr.801] Mark detection signal compensation time

Compensate the input timing of the mark detection signal.

Set this parameter to compensate such as delay of sensor input. (Set a positive value to compensate for a delay.)

## [Pr.802] Mark detection data type

Set the data that latched at mark detection.

The target data is latched by setting "0 to 12". Set the axis No. in "[Pr.803] Mark detection data axis No.".

Optional 2 word buffer memory is latched by setting "-1". Set the buffer memory No. in "[Pr.804] Mark detection data buffer memory No.".

| Setting value | Data name |
|---|---|
| 0 | Current feed value |
| 1 | Machine feed value |
| 2 | Real current value |
| 3 | Servo input axis current value |
| 6 | Synchronous encoder axis current value |
| 7 | Synchronous encoder axis current value per cycle |
| 8 | Current value after composite main shaft gear |
| 9 | Current value per cycle after main shaft gear |
| 10 | Current value per cycle after auxiliary shaft gear |
| 11 | Cam axis current value per cycle |
| 12 | Cam axis current value per cycle (Real position) |
| -1 | Optional 2 words buffer memory |

If a value other than the above is set, the warning "Outside mark detection data type setting range" (warning code: 0937H) occurs and the target mark detection is not available.

## [Pr.803] Mark detection data axis No.

Set the axis No. of data that latched at mark detection.

| [Pr.802] Mark detection data type | | | [Pr.803] Mark detection data axis No. | | | |
|---|---|---|---|---|---|---|
| Setting value | Data name | Unit | RD77MS2 | RD77MS4 | RD77MS8 | RD77MS16 |
| 0 | Current feed value | $10^{-1}$ [μm], $10^{-5}$ [inch], $10^{-5}$ [degree], [pulse] | 1 to 2 | 1 to 4 | 1 to 8 | 1 to 16 |
| 1 | Machine feed value | | | | | |
| 2 | Real current value | | | | | |
| 3 | Servo input axis current value | | | | | |
| 6 | Synchronous encoder axis current value | Synchronous encoder axis position unit | 801 to 804 | | | |
| 7 | Synchronous encoder axis current value per cycle | | | | | |
| 8 | Current value after composite main shaft gear | Main input axis position unit | 1 to 2 | 1 to 4 | 1 to 8 | 1 to 16 |
| 9 | Current value per cycle after main shaft gear | Cam axis cycle unit | | | | |
| 10 | Current value per cycle after auxiliary shaft gear | | | | | |
| 11 | Cam axis current value per cycle | | | | | |
| 12 | Cam axis current value per cycle (Real position)*1 | | | | | |

*1 Cam axis current value per cycle that considered delay of the servo system.

If a value other than the above is set, the warning "Outside mark detection data axis No. setting range" (warning code: 0938H) occurs and the target mark detection is not available.

## [Pr.804] Mark detection data buffer memory No.

Set the No. of optional 2 words buffer memory that latched at mark detection.

Set this No. as an even No.

If a value other than the above is set, the warning "Outside mark detection data buffer memory No. setting range" (warning code: 0939H) occurs and the target mark detection is not available.

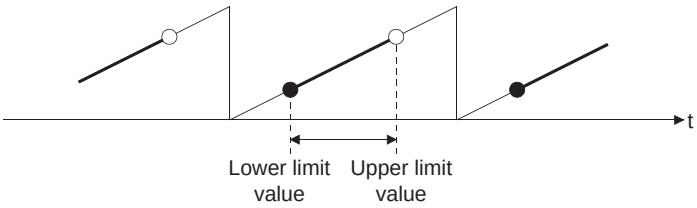
## [Pr.805] Latch data range upper limit value, [Pr.806] Latch data range lower limit value

Set the upper limit value and lower limit value of the latch data at mark detection.

When the data at mark detection is within the range, they are stored in "[Md.801] Mark detection data storage area (1 to 32)" and the "[Md.800] Number of mark detection" is incremented by 1. The mark detection processing is not executed.

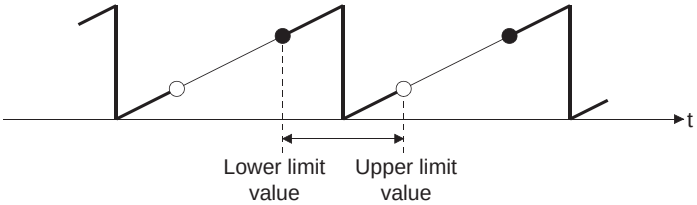
• Upper limit value > Lower limit value

The mark detection is executed when the mark detection data is "greater or equal to the lower limit value and less than the upper limit value".




• Upper limit value < Lower limit value

The mark detection is executed when the mark detection data is "greater or equal to the lower limit value or less than the upper limit value".




• Upper limit value = Lower limit value

The mark detection range is not checked. The mark detection is executed for all range.

## [Pr.807] Mark detection mode setting

Set the data storage method of mark detection.

| Mode | Setting value | Operation for mark detection | Mark detection data storage method |
|---|---|---|---|
| Continuous detection mode | 0 | Always | The data is updated in the mark detection data storage area 1. |
| Specified number of detection mode | 1 to 32 | Number of detections<br>(If the number of mark detection is the number of detections or more, the mark detection is not executed.) | The data is stored to the mark detection data storage area "n".<br>n = (1 + Number of mark detection) |
| Ring buffer mode | -1 to -32 | Always<br>(The mark detection data storage area 1 to 32 is used as a ring buffer for the number of detections.) | |

## Mark detection control data

k: Mark detection setting No. - 1

| Setting item | | Setting details/setting value | Default value | Buffer memory address |
|---|---|---|---|---|
| [Cd.800] | Number of mark detection clear request | Set "1" to execute "0" clear of number of mark detections.<br>"0" is automatically set after completion by "0" clear of number of mark detections.<br>1: 0 clear of number of mark detections<br>Fetch cycle: Operation cycle | 0 | 54640+10k |
| [Cd.801] | Mark detection invalid flag | Set this flag to invalidate mark detection temporarily.<br>1: Mark detection: Invalid<br>Others: Mark detection: Valid<br>Fetch cycle: Operation cycle | 0 | 54641+10k |
| [Cd.802] | Latch data range change request | Request the processing of latch data range change.<br>Set the following value depending on the timing of updating the change value.<br>1: Change in the next Operation cycle of the requested<br>2: Change in the next DI input of the requested<br>"0" is automatically set after the change is completed.<br>Fetch cycle: Operation cycle or DI input | 0 | 54642+10k |

## [Cd.800] Number of mark detection clear request

Set "1" to execute "0" clear of "[Md.800] Number of mark detection". "0" is automatically set after completion by "0" clear of "[Md.800] Number of mark detection".

## [Cd.801] Mark detection invalid flag

Set "1" to invalidate mark detection temporarily. The mark detection signal during invalidity is ignored.

## [Cd.802] Latch data range change request

Request the processing of latch data range change. Set the following value depending on the timing of updating the change value.

1: Change in the next Operation cycle of the requested

2: Change in the next DI input of the requested

- "0" is automatically set after receiving the latch data range change request. (It indicates that the latch data range change is completed.)
- "[Pr.805] Latch data range upper limit value" and "[Pr.806] Latch data range lower limit value" at latch data range change request are used as the change value.
- Restrictions according to the type of latch data range change request are shown below.

○: Possible, ×: Not possible

| Types of change request | [Cd.801] Mark detection invalid flag | Changing possibility |
|---|---|---|
| 1: Change in the next Operation cycle of the requested | 1: Mark detection: Invalid | ○ |
| | Other than 1: Mark detection: Valid | |
| 2: Change in the next DI input of the requested | 1: Mark detection: Invalid | × |
| | Other than 1: Mark detection: Valid | ○ |

## Mark detection monitor data

k: Mark detection setting No. - 1

| Storage item | | Storage details/storage value | Buffer memory address |
|---|---|---|---|
| [Md.800] | Number of mark detection | The number of mark detections is stored.<br>"0" clear is executed at power supply ON.<br>Continuous detection mode: 0 to 65535 (Ring counter)<br>Specified number of detection mode: 0 to 32<br>Ring buffer mode: 0 to (number of buffers - 1)<br>Refresh cycle: At mark detection | 54960+80k |
| [Md.801] | Mark detection data storage area 1<br>⋮<br>Mark detection data storage area 32 | The latch data at mark detection is stored.<br>Data for up to 32 times are stored in the specified number of detection mode.<br>Data are stored as a ring buffer for number of detections in the ring buffer mode.<br>-2147483648 to 2147483647<br>Refresh cycle: At mark detection | 54962+80k<br>54963+80k<br>⋮<br>55024+80k<br>55025+80k |

## [Md.800] Number of mark detection

The counter value is incremented by 1 at mark detection. Preset "0" clear in "[Cd.800] Number of mark detection clear request" to execute the mark detection in specified number of detections mode or ring buffer mode.

## [Md.801] Mark detection data storage area (1 to 32)

The latch data at mark detection is stored. Data for up to 32 times can be stored in the specified number of detection mode or ring buffer mode.

## Precautions

- When the data of "[Pr.802] Mark detection data type" or "[Pr.803] Mark detection data axis No." is selected incorrectly, the incorrect latch data is stored. For the data of "[Pr.802] Mark detection data type", set the item No. instead of specifying the buffer memory No. directly.
- When "9: Current value per cycle after main shaft gear" or "10: Current value per cycle after auxiliary shaft gear" is set to "[Pr.802] Mark detection data type" and the mark detection is executed right after the cam axis length per cycle is changed during synchronous control, the data before the cam axis length per cycle is changed may be latched. At the time, the latch data is calculated based on the executing cam axis length per cycle. Therefore, the value different from the actual output monitor data may be latched.

# 9.10 Optional Data Monitor Function

This function is used to store the data (refer to following table) up to four points per axis to the buffer memory and monitor them.

## Data that can be set

○: Possible, —: Not possible ("0" is stored.)

| Data type | | Unit | Used point | Monitoring possibility | | |
|---|---|---|---|---|---|---|
| | | | | MR-J3(W)-B | MR-J4(W)-B | MR-JE-B |
| 1 | Effective load ratio | [%] | 1 word | ○ | ○ | |
| 2 | Regenerative load ratio | [%] | | ○ | ○ | |
| 3 | Peak load factor | [%] | | ○ | ○ | |
| 4 | Load inertia moment ratio | [× 0.1] | | ○ | ○ | |
| 5 | Model loop gain | [rad/s] | | ○ | ○ | |
| 6 | Bus voltage | [V] | | ○ | ○ | |
| 7 | Servomotor rotation speed*1 | [r/min] | | ○ | ○ | |
| 8 | Encoder multiple revolution counter | [rev] | | ○ | ○ | |
| 9 | Module power consumption | [W] | | — | ○ | |
| 10 | Instantaneous torque | [× 0.1%] | | — | ○ | |
| 12 | Servomotor thermistor temperature | [℃] | | ○ | ○ | |
| 13 | Equivalent disturbance torque | [× 0.1%] | | — | ○ | |
| 14 | Overload alarm margin | [× 0.1%] | | — | ○ | |
| 15 | Error excessive alarm margin | [× 16 pulses] | | — | ○ | |
| 16 | Settling time | [ms] | | — | ○ | |
| 17 | Overshoot amount | [pulse] | | — | ○ | |
| 20 | Position feedback | [pulse] | 2 words | ○ | ○ | |
| 21 | Encoder single revolution position | [pulse] | | ○ | ○ | |
| 22 | Selection droop pulse*2 | [pulse] | | ○ | ○ | |
| 23 | Module integral power consumption | [Wh] | | — | ○ | |
| 24 | Load side encoder information 1 | [pulse] | | ○*4 | ○*4*5 | — |
| 25 | Load side encoder information 2 | — | | ○*4 | ○*4*5 | — |
| 26 | Z-phase counter | [pulse] | | — | ○*3 | |
| 27 | Servomotor side/load-side position deviation | [pulse] | | — | ○*4 | |
| 28 | Servomotor side/load-side speed deviation | [× 0.01 r/min] | | — | ○*4 | |
| 30 | Module power consumption (2 words) | [W] | | — | ○ | |

*1 The motor speed that took the average every 227 [ms].
Use the servo amplifiers of version compatible with the monitor of motor speed.
Always "0" if the monitor is executed for the servo amplifier which does not support this function.

*2 The data set to "Droop pulse monitor selection for controller display" of "Fully closed loop function selection 3 (PE10)" is monitored.

*3 It can be monitored when using the linear servo motors.

*4 It can be monitored when using the fully closed control.

*5 It can be monitored when using the synchronous encoder via servo amplifier.

Refer to each servo amplifier instruction manual for details of the data monitored.

## List of parameters and data

The parameters and data used in the optional data monitor function is shown below.

### ■Expansion parameter

n: Axis No. - 1

| Setting item | | Setting details/setting value | Buffer memory address |
|---|---|---|---|
| [Pr.91] | Optional data monitor: Data type setting 1 | • Set the data type monitored in optional data monitor function every data type setting. (☞ Page 340 Data that can be set)<br>• When "0: No setting" is set, the stored value of "[Md.109] Regenerative load ratio/Optional data monitor output 1" to "[Md.112] Optional data monitor output 4" is different every data type setting 1 to 4. (☞ Page 341 Axis monitor data) | 100+150n |
| [Pr.92] | Optional data monitor: Data type setting 2 | | 101+150n |
| [Pr.93] | Optional data monitor: Data type setting 3 | | 102+150n |
| [Pr.94] | Optional data monitor: Data type setting 4 | | 103+150n |

**Point**

- The monitor address of optional data monitor is registered to servo amplifier with initialized communication after the power supply is turned ON or the CPU module is reset.
- Set the data type of "used point: 2 words" in "[Pr.91] Optional data monitor: Data type setting 1" or "[Pr.93] Optional data monitor: Data type setting 3". If it is set in "[Pr.92] Optional data monitor: Data type setting 2" or "[Pr.94] Optional data monitor: Data type setting 4", the warning "Optional data monitor data type setting error" (warning code: 0933H) will occur with initialized communication to servo amplifier, and "0" is set in [Md.109] to [Md.112].
- Set "0" in "[Pr.92] Optional data monitor: Data type setting 2" when the data type of "used point: 2 words" is set in "[Pr.91] Optional data monitor: Data type setting 1", and set "0" in "[Pr.94] Optional data monitor: Data type setting 4" when the data type of "used point: 2 words" is set in "[Pr.93] Optional data monitor: Data type setting 3". When other than "0" is set, the warning "Optional data monitor data type setting error" (warning code: 0933H) will occur with initialized communication to servo amplifier, and "0" is set in [Md.109] to [Md.112].
- When the data type of "used point: 2 words" is set, the monitor data of low-order is "[Md.109] Regenerative load ratio/Optional data monitor output 1" or "[Md.111] Peak torque ratio/Optional data monitor output 3".
- Refer to ☞ Page 340 Data that can be set for the data type that can be monitored on each servo amplifier. When the data type that cannot be monitored is set, "0" is stored to the monitor output.

### ■Axis monitor data

n: Axis No. - 1

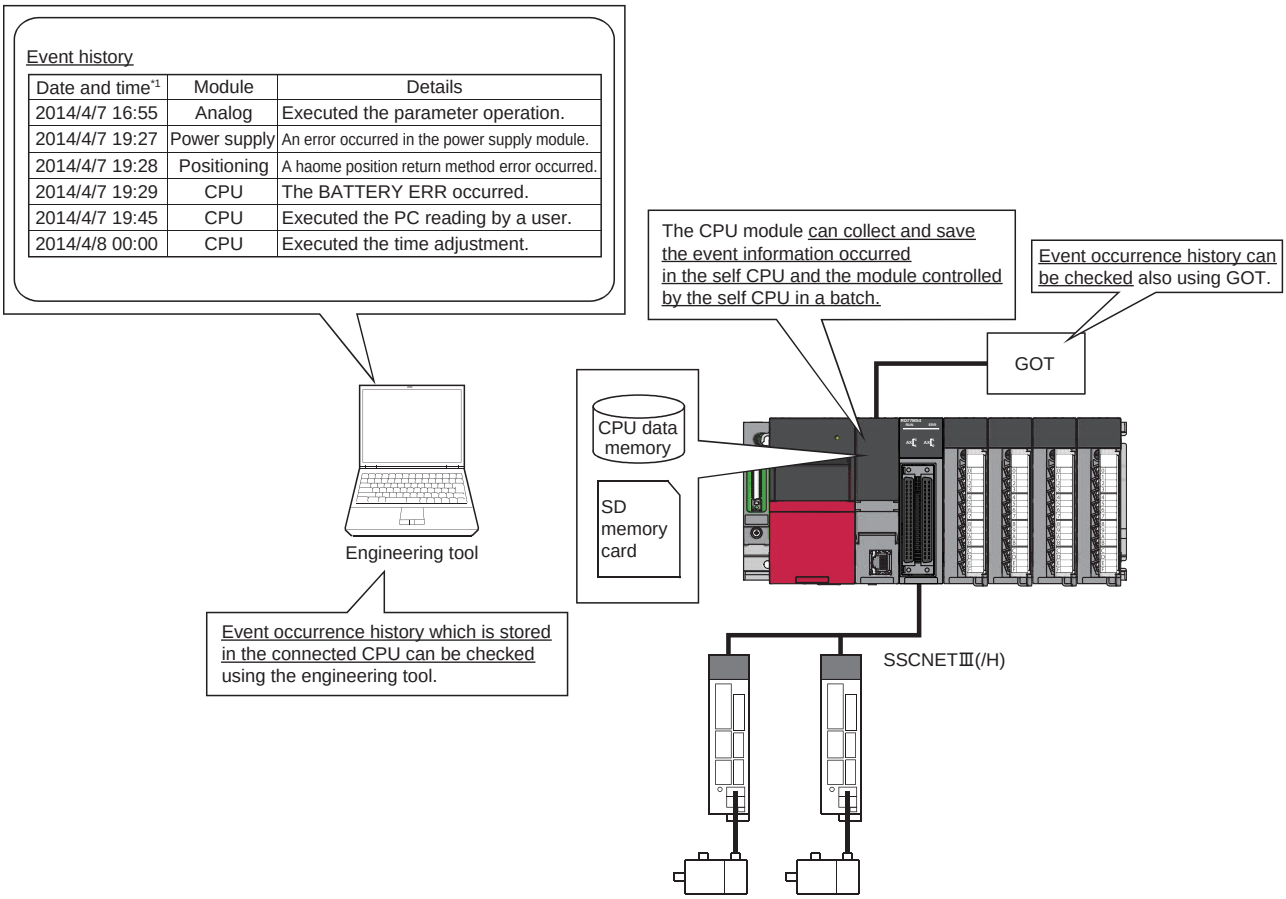
| Storage item | | Storage details/storage value | Buffer memory address |
|---|---|---|---|
| [Md.109] | Regenerative load ratio/Optional data monitor output 1 | • The content set in "[Pr.91] Optional data monitor: Data type setting 1" is stored at optional data monitor data type setting.<br>• The regenerative load ratio is stored when nothing is set. | 2478+100n |
| [Md.110] | Effective load torque/Optional data monitor output 2 | • The content set in "[Pr.92] Optional data monitor: Data type setting 2" is stored at optional data monitor data type setting.<br>• The effective load ratio is stored when nothing is set. | 2479+100n |
| [Md.111] | Peak torque ratio/Optional data monitor output 3 | • The content set in "[Pr.93] Optional data monitor: Data type setting 3" is stored at optional data monitor data type setting.<br>• The peak torque ratio is stored when nothing is set. | 2480+100n |
| [Md.112] | Optional data monitor output 4 | • The content set in "[Pr.94] Optional data monitor: Data type setting 4" is stored at optional data monitor data type setting.<br>• "0" is stored when nothing is set. | 2481+100n |

**Point**

When the communication interrupted by the servo amplifier's power supply OFF or disconnection of communication cable with servo amplifiers during optional data monitor, "0" is stored in [Md.109] to [Md.112].

# 9.11 Event History Function

The "event history function" is used to save the error information and the operation for the module as an event in the data memory or an SD memory card of the CPU module. The saved event information can be displayed with an engineering tool and the occurrence history can be checked in chronological order. The detail information of the error also can be checked by referring to "Optional information" in event history.


Event history
Date and time*1 | Module | Details
2014/4/7 16:55 | Analog | Executed the parameter operation.
2014/4/7 19:27 | Power supply | An error occurred in the power supply module.
2014/4/7 19:28 | Positioning | A haome position return method error occurred.
2014/4/7 19:29 | CPU | The BATTERY ERR occurred.
2014/4/7 19:45 | CPU | Executed the PC reading by a user.
2014/4/8 00:00 | CPU | Executed the time adjustment.
The CPU module can collect and save the event information occurred in the self CPU and the module controlled by the self CPU in a batch.
Event occurrence history can be checked also using GOT.
GOT
CPU data memory
SD memory card
Engineering tool
Event occurrence history which is stored in the connected CPU can be checked using the engineering tool.
SSCNETⅢ(/H)

*1 Displays a value set by the clock function of the CPU module.

## Event occurred in the Simple Motion module

The items saved in the event history are shown in the table below.

| Event type | Category | Details | Event item | Event code |
|---|---|---|---|---|
| System | Error | An error is detected by the Simple Motion module. | Major error | 03C00 to 03FFF |
| | | | Moderate error | 02000 to 03BFF |
| | | | Minor error | 01000 to 01FFF |
| | Warning | A warning is detected by the Simple Motion module. | Warning | 00800 to 00FFF |
| | Information | None | None | — |
| Security | Error | None | None | — |
| | Warning | None | None | — |
| | Information | None | None | — |
| Operation | Error | None | None | — |
| | Warning | None | None | — |
| | Information | The operation shown on the right column by an user is detected by the Simple Motion module. | Module initialization (Parameter initialization) | 20010 |
| | | | Module backup (Execution data backup) | 20011 |
| | | | Online module change | 20030 |

## Detailed information of error/warning event

The items displayed in the detailed information, which vary depending on each error category, are configured by the items shown in the table below.

| Error category | Detailed information 1 | Detailed information 2 | Detailed information 3 |
|---|---|---|---|
| H/W error | — | — | — |
| Positioning control in common<br>Home position return<br>Absolute position restoration<br>Manual control<br>Positioning operation<br>Block start data<br>Positioning data<br>Speed-torque control *3<br>Cam data operation | Axis information<br>• Axis in which an event occurred<br>• Axis operation status<br>• Start No.*4<br>• Data No. in which an event occurred*4<br>• Factor axis<br>• Block start Point No. at start*4<br>• Block start Point No. at occurrence*4<br>• Data by each error | Current value<br>• Feed current value<br>• Actual current value<br>• Feedrate<br>• Unit | Signal<br>• PLC READY<br>• All axis servo ON<br>• BUSY<br>• External input signal ([Md.30])<br>• Servo status 1<br>• Servo status 2<br>• Servo status 3 |
| Synchronous control (Input axis) | Axis information<br>• Axis in which an event occurred (For a synchronous encoder axis, 800 + Axis No.)<br>• Axis operation status (For a synchronous encoder axis, always 0)<br>• Data by each error | — | — |
| Synchronous control (Output axis) | Axis information<br>• Axis in which an event occurred<br>• Axis operation status<br>• Cam data No. when an error occurred<br>• Data by each error | Current value<br>• Feed current value<br>• Unit | — |
| Servo amplifier | Axis information<br>• Axis in which an event occurred<br>• Axis operation status<br>• Start No.*1*4<br>• Data No. in which an event occurred*1*4<br>• Block start Point No. at start*4<br>• Block start Point No. at occurrence*4<br>• Connected device<br>• Servo alarm<br>• Data by each error | Current value<br>• Feed current value<br>• Actual current value<br>• Unit<br>• Motor speed (0.01 r/min)<br>• Motor current value (0.1%) | Signal<br>• Servo status 1<br>• Servo status 2<br>• Servo status 3 |
| I/F<br>• Hold error<br>• Flash ROM error<br>• CPU module error | System information<br>• Number of write accesses to flash ROM<br>• Data by each error | — | — |
| Parameter setting range error<br>• Common parameter<br>• Basic parameter<br>• Detailed parameter<br>• Home position return parameter<br>• Expansion parameter<br>• Servo parameter | Axis information<br>• Axis in which an event occurred*2<br>• Data by each error | Setting value<br>• Parameter 1<br>• Setting value 1<br>• Parameter 2<br>• Setting value 2<br>• Parameter 3<br>• Setting value 3<br>Displays the number of parameters in which an error occurred. | Setting value<br>• Parameter 4<br>• Setting value 4<br>• Parameter 5<br>• Setting value 5<br>• Parameter 6<br>• Setting value 6<br>Displays the number of parameters in which an error occurred. |

*1 Output only at positioning control. Otherwise, "-" is output.
At the time other than the positioning control (during home position return or JOG operation, etc.), judge the timing of when an error occurred by the axis operation status.

*2 For common parameters, an axis in which an event occurred is set to "Axis 1".

*3 For an error code which is independent of an axis, the information for an axis in which an event occurred is not displayed.
(For an error code which is independent of an axis, refer to the following.
☞ Page 574 TROUBLESHOOTING)

*4 The following table shows the display of the start No., data No. in which an event occurred, block start point No. at start, and block start point No. at occurrence.

| Details of start (Positioning start No.) | | Start No. | Occurred data No. | Point No. at block start | No. at block start occurrence |
|---|---|---|---|---|---|
| Positioning start (1 to 600) | At start (Analyzing) | Started positioning No. (1 to 600) | ← (Same as start No.)*1 | Not displayed | |
| | Operating | | Data No. in which an error occurred (1 to 600) | | |
| Block start (7000 to 7004) | At start (Analyzing) | Started block start No. (7000 to 7004) | Start data No. of point No. at block start (1 to 600)*1 | Started block start point No. (1 to 50) | ← (Same as point No. at block start) |
| | Operating | | Data No. in which an error occurred (1 to 600) | Started block start point No. (1 to 50) | Block start point No. in which an error occurred (1 to 50) |
| Home position return (9001) | At start (Analyzing) | 9001 | Not displayed | Not displayed | |
| | Operating | | | | |
| Fast home position return (9002) | At start (Analyzing) | 9002 | | | |
| | Operating | | | | |
| Current value changing (9003) | At start (Analyzing) | 9003 | | | |
| | Operating | | | | |
| Multiple axes simultaneous start (9004) | At start (Analyzing) | 9004 | Data No. at start (1 to 600)*1 | | |
| | Operating | | Data No. in which an error occurred (1 to 600) | | |
| JOG operation | At start (Analyzing) | 9010 | Not displayed | | |
| | Operating | | | | |
| Manual pulse generator operation | At start (Analyzing) | 9011 | | | |
| | Operating | | | | |
| Speed-torque control | Mode switching | 9030 to 9042 | | | |
| | Operating | | | | |
| Positioning start No. outside the setting range | | Setting value out of the range | | | |

*1 At start (during analyzing), "0" is displayed when the error processing is executed before fetching the start data No. from the buffer memory.
When a value outside the setting range is set, a setting value outside the range is displayed.

## Event information skipped

When the module errors of the Simple Motion module frequently occur in the intervals shorter than the event history collection intervals of the CPU module, the event history storage area in the Simple Motion module might be full of error information which the CPU module has not collected. If a new module error occurs in this state, the Simple Motion module discards the module error information and outputs the message "*HST.LOSS*" (The event information has been erased.) which indicates the event information has been erased.

# 9.12 Connect/Disconnect Function of SSCNET Communication



Temporarily connect/disconnect of SSCNET communication is executed during system's power supply ON. This function is used to exchange the servo amplifiers or SSCNETⅢ cables.

## Control details

Set the connect/disconnect request of SSCNET communication in "[Cd.102] SSCNET control command", and the status for the command accept waiting or execute waiting is stored in "[Md.53] SSCNET control status". Use this buffer memory to connect the servo amplifiers disconnected by this function.

When the power supply module of head axis of SSCNET system (servo amplifier connected directly to the Simple Motion module) turns OFF/ON, this function is not necessary.

## Precautions during control

- Confirm the LED display of the servo amplifier for "AA" after completion of SSCNET communication disconnect processing. And then, turn OFF the servo amplifier's power supply.
- The "[Md.53] SSCNET control status" only changes into the "-1: Execute waiting" even if the "Axis No.: Disconnect command of SSCNET communication" or "-10: Connect command of SSCNET communication" is set in "[Cd.102] SSCNET control command". The actual processing is not executed. Set "-2: Execute command" in "[Cd.102] SSCNET control command" to execute.
- When the "Axis No.: Disconnect command of SSCNET communication" is set to axis not connect or virtual servo amplifier, the status will not change without "[Md.53] SSCNET control status" becoming "-1: Execute waiting".
- Operation failure may occur in some axes if the servo amplifier's power supply is turned OFF without using the disconnect function. Be sure to turn OFF the servo amplifier's power supply by the disconnect function.
- Execute the connect/disconnect command to the A-axis for multiple-axis servo amplifier.
- When using the driver communication function, it can be disconnected by executing the connect/disconnect command, however it cannot be connected again.
- The connect/disconnect/execute command cannot be accepted during amplifier-less operation mode. "[Md.53] SSCNET control status" will be "0: Command accept waiting" (The disconnection is released.). If being switched to the amplifier-less operation mode when "[Md.53] SSCNET control status" is "1: Disconnected axis existing", the disconnected axis is automatically connected when switching to the normal operation mode again. If being switched to the amplifier-less operation mode when "[Md.53] SSCNET control status" is "-1: Execute waiting", the connect/disconnect command becomes invalid.

## Data list

The data for the connect/disconnect function of SSCNET communication is shown below.

### ■System control data

| Setting item | | Setting value | Setting details | Buffer memory address |
|---|---|---|---|---|
| [Cd.102] | SSCNET control command | → | The connect/disconnect command of SSCNET communication is executed.<br>0: No command<br>Axis No.*1: Disconnect command of SSCNET communication (Axis No. to be disconnected)<br>-2: Execute command<br>-10: Connect command of SSCNET communication<br>Except above setting: Invalid | 5932 |

*1 1 to the maximum control axes

### ■System monitor data

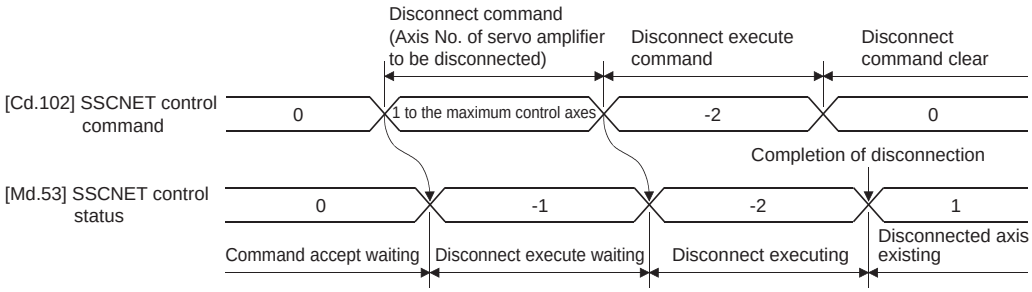
| Monitor item | | Monitor value | Storage details | Buffer memory address |
|---|---|---|---|---|
| [Md.53] | SSCNET control status | → | The connect/disconnect status of SSCNET communication is stored.<br>1: Disconnected axis existing<br>0: Command accept waiting<br>-1: Execute waiting<br>-2: Executing | 4233 |

## Procedure to connect/disconnect

Procedure to connect/disconnect at the exchange of servo amplifiers or SSCNETⅢ cables is shown below.

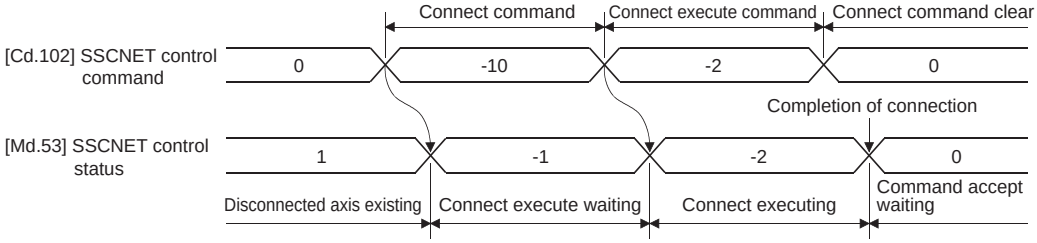
### ■Procedure to disconnect

1. Set the axis No. to disconnect in "[Cd.102] SSCNET control command". (Setting value: 1 to the maximum control axes)
2. Check that "-1: Execute waiting" is stored in "[Md.53] SSCNET control status". (Disconnect execute waiting)
3. Set "-2: Execute command" in "[Cd.102] SSCNET control command".
4. Check that "1: Disconnected axis existing" is stored in "[Md.53] SSCNET control status". (Completion of disconnection. "20: Servo amplifier has not been connected" is stored in "[Md.26] Axis operation status".)
5. Turn OFF the servo amplifier's power supply after checking the LED display "AA" of servo amplifier to be disconnected.




### ■Procedure to connect

1. Turn ON the servo amplifier's power supply.
2. Set "-10: Connect command of SSCNET communication" in "[Cd.102] SSCNET control command".
3. Check that "-1: Execute waiting" is set in "[Md.53] SSCNET control status". (Connect execute waiting)
4. Set "-2: Execute command" in "[Cd.102] SSCNET control command".
5. Check that "0: Command accept waiting" is set in "[Md.53] SSCNET control status". (Completion of connection)
6. Resume operation of servo amplifier after checking "0: Standby" in "[Md.26] Axis operation status" of the connected axis.




**Point**

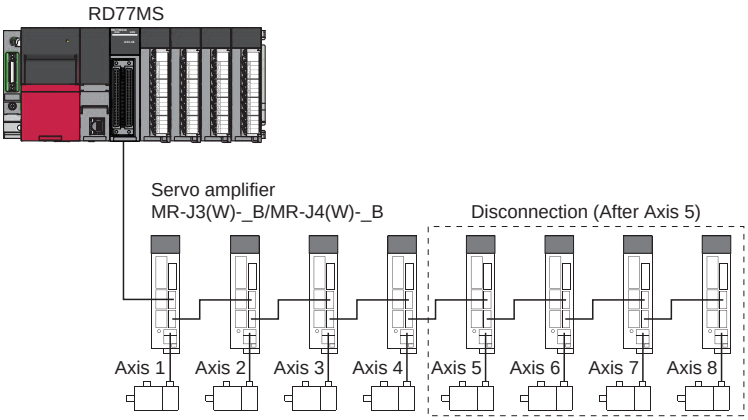
When "-1: Execute waiting" is set in "[Md.53] SSCNET control status", the command of execute waiting can be canceled if "0: No command" is set in "[Cd.102] SSCNET control command".

## Program

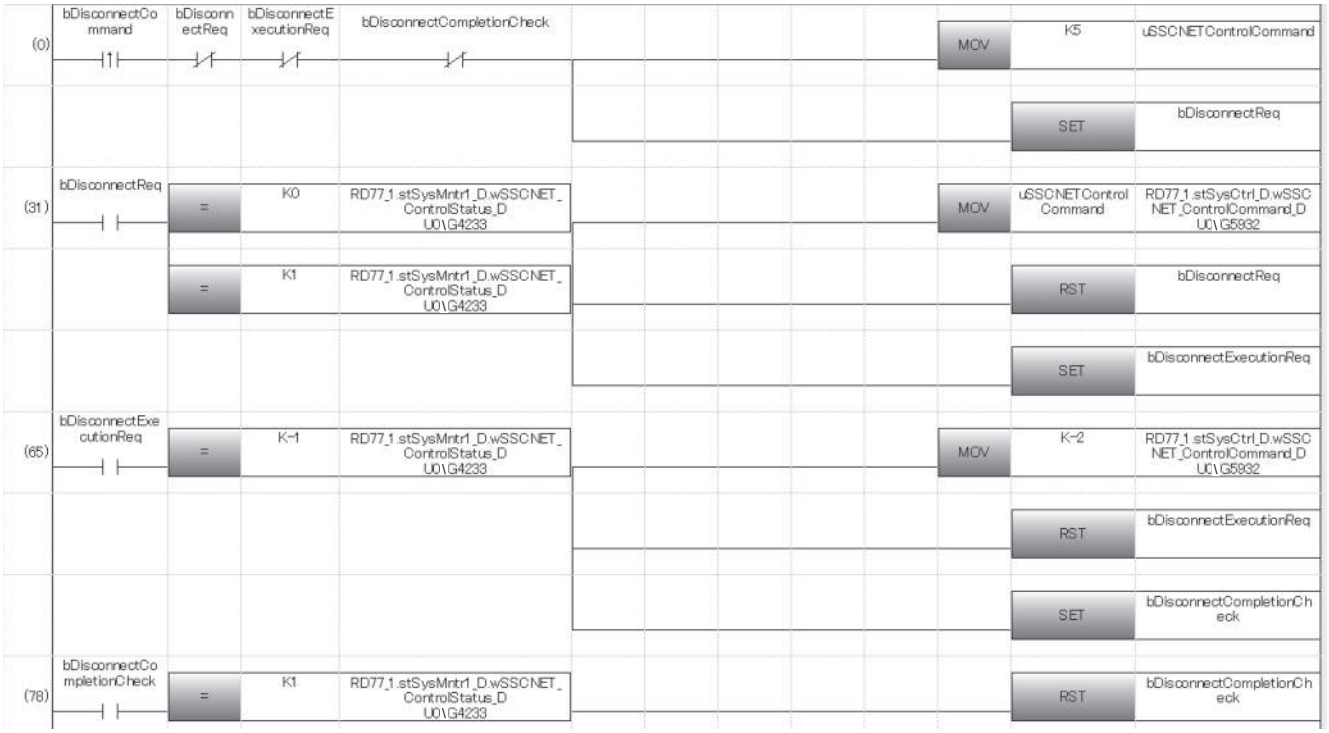
The following shows the program example to connect/disconnect the servo amplifiers connected after Axis 5.

| Disconnect procedure | Connect procedure |
|---|---|
| Turn OFF the servo amplifier's power supply after checking the LED display "AA" of servo amplifier by turning bDisconnectCommand from OFF to ON. | Resume operation of servo amplifier after checking the "[Md.26] Axis operation status" of the connected servo amplifier by turning bConnectCommand from OFF to ON. |

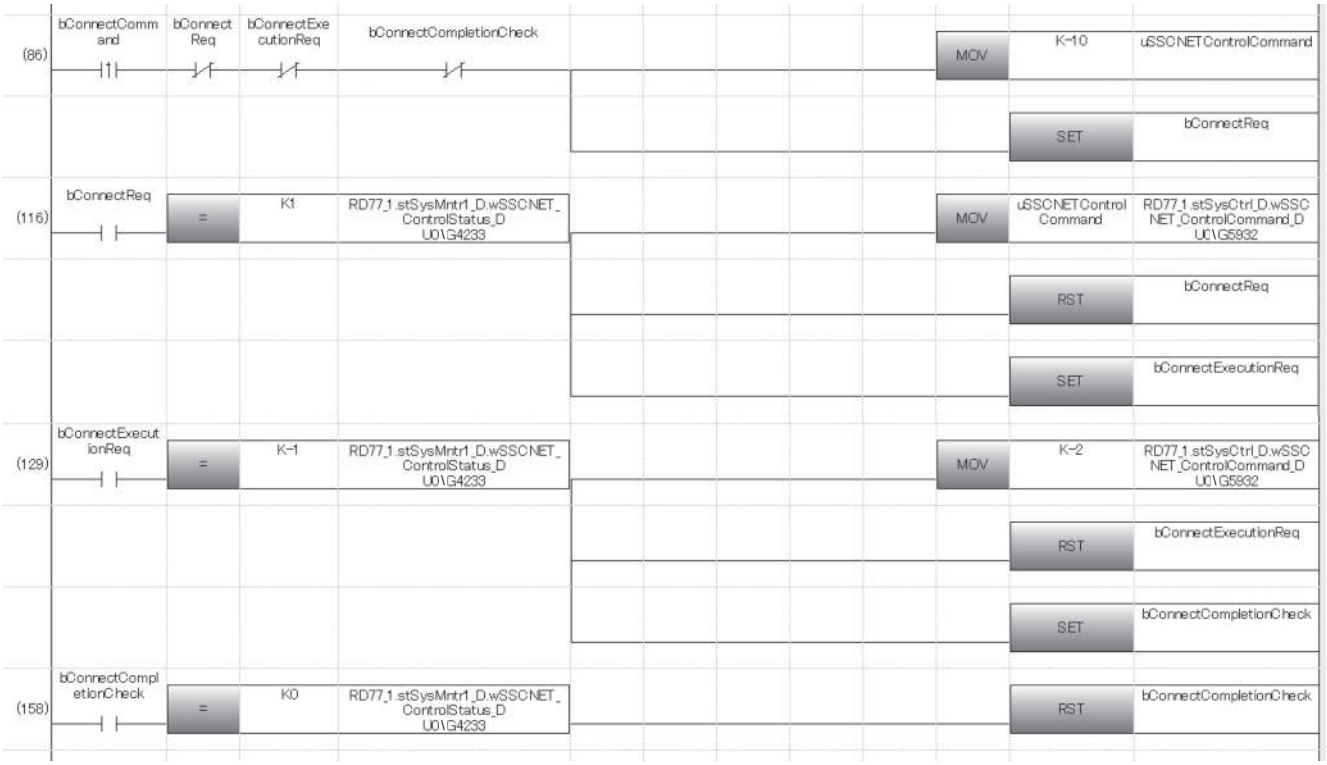
System configuration




### ■Disconnect operation



## ■Connect operation




| Classification | Label name | Description |
|---|---|---|
| Module label | RD77_1.stSysMntr1_D.wSSCNET_ControlStatus_D | Axis 1 SSCNET control status |
| | RD77_1.stSysCtrl_D.wSSCNET_ControlCommand_D | Axis 1 SSCNET control command |
| Global label, local label | Defines the global label or the local label as follows. The settings of Assign (Device/Label) are not required for the label that the assignment device is not set because the unused internal relay and data device are automatically assigned. | |

| | Label Name | Data Type | | Class |
|---|---|---|---|---|
| 1 | bDisconnectCommand | Bit | ... | VAR |
| 2 | bDisconnectReq | Bit | ... | VAR |
| 3 | bDisconnectExecutionReq | Bit | ... | VAR |
| 4 | bDisconnectCompletionCheck | Bit | ... | VAR |
| 5 | bConnectCommand | Bit | ... | VAR |
| 6 | bConnectReq | Bit | ... | VAR |
| 7 | bConnectExecutionReq | Bit | ... | VAR |
| 8 | bConnectCompletionCheck | Bit | ... | VAR |
| 9 | uSSCNETControlCommand | Word [Signed] | ... | VAR |
| 10 | | | ... | |

# 9.13 Online module change



Allows to replace a module without stopping the system. For procedures for the online module change, refer to the following.

MELSEC iQ-R Online Module Change Manual

# 9.14 Hot line forced stop function

This function is used to execute deceleration stop safety for other axes when the servo alarm occurs in the servo amplifier MR-JE-B.

## Control details

The hot line forced stop function is set in the servo parameter. This function can execute deceleration stop for other axes without via Simple Motion module by notifying the servo alarm occurrence. For details, refer to the following.

MR-JE-_B Servo Amplifier Instruction Manual

This function is enabled at the MR-JE-B factory-set. To disable this function, set "1: Disabled" in the servo parameter "Hot line forced stop function Hot line forced stop function selection (PA27)".

Also, when the system is configured with MR-JE-B and MR-J4-B, this function can execute deceleration stop for MR-J4-B at the servo alarm occurrence in MR-JE-B. To execute deceleration stop for MR-J4-B, set "2: Enabled" in the servo parameter of MR-J4-B "Hot line forced stop function Deceleration to stop selection (PA27)". ("0: Disabled" is set at factory-set.)

The following shows the setting value of the servo parameter (PA27) and the operation of servo amplifier.

[MR-JE-B]

| Setting value of "Hot line forced stop function Hot line forced stop function selection (PA27)" | Output hot line | Deceleration stop when receiving the hot line signal |
|---|---|---|
| 0: Enabled (Initial value) | Enabled | Enabled |
| 1: Disabled | Disabled | Disabled |

[MR-J4-B]

| Setting value of "Hot line forced stop function Deceleration to stop selection (PA27)" | Output hot line | Deceleration stop when receiving the hot line signal |
|---|---|---|
| 0: Disabled (Initial value) | Disabled | Disabled |
| 2: Enabled | Disabled | Enabled |

Use the software version that supports the hot line forced stop function for the servo amplifier to use the hot line forced stop function.

The following table shows the software version of servo amplifier that supports the hot line forced stop function.

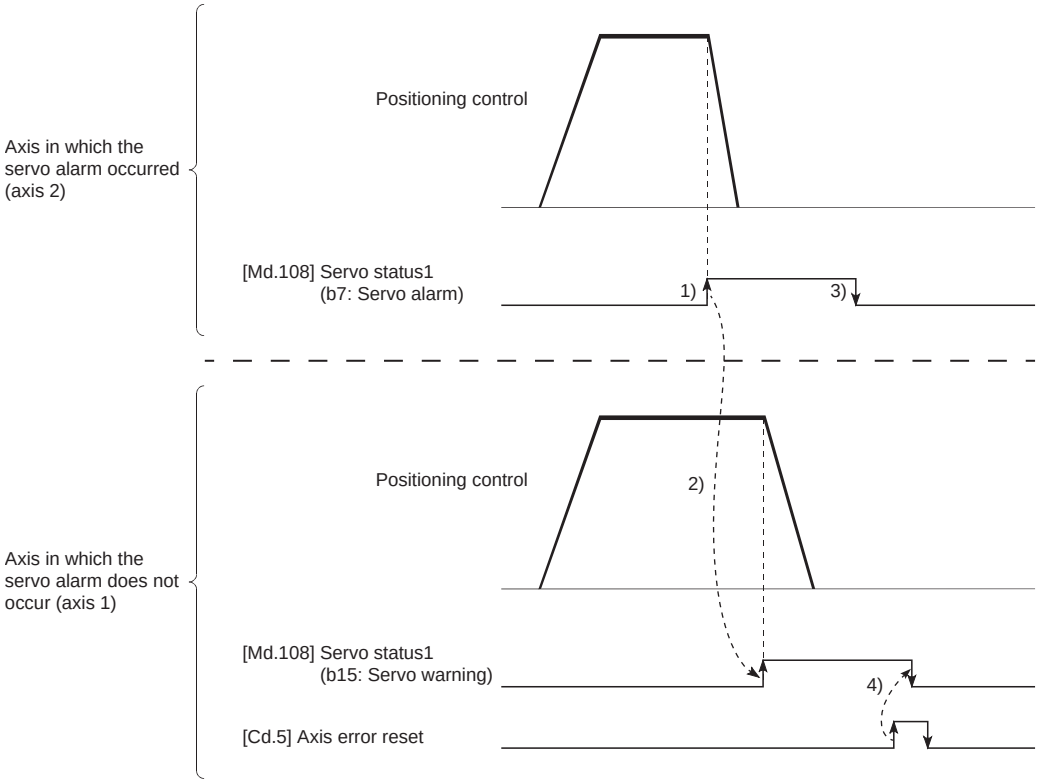
| Servo amplifier type | Software version |
|---|---|
| MR-J4(W)-B | B7 or later |
| MR-JE-B | B6 or later |

*1 The servo amplifier except above does not support the hot line forced stop function. Therefore, it does not output the hot line or execute deceleration stop by receiving the hot line signal.

## Precautions during control

- The servo warning "Controller forced stop warning" (warning No.: E7) occurs in the axis where the hot line forced stop function executes deceleration stop.
- To clear the servo warning "Controller forced stop warning" (warning No.: E7) occurred by the hot line forced stop function, set "1" in "[Cd.5] Axis error reset" for each axis after the factor is removed in the axis where the servo alarm occurred. Even if "1" is set in "[Cd.5] Axis error reset" before the factor is not removed, the servo warning "Controller forced stop warning" (warning No.: E7) is not cleared.

• The following shows the timing chart at the servo alarm occurrence.


Axis in which the servo alarm occurred (axis 2)
Positioning control
[Md.108] Servo status1 (b7: Servo alarm)
1)
3)
Axis in which the servo alarm does not occur (axis 1)
Positioning control
2)
[Md.108] Servo status1 (b15: Servo warning)
4)
[Cd.5] Axis error reset

1) The servo alarm occurs in axis 2 and the servomotor stops with dynamic brake.

2) The notification from the alarm occurrence axis is received in axis 1. The servo warning ("[Md.108] servo status1": b15) is turned ON and the deceleration stop is executed.

3) The servo alarm ("[Md.108] Servo status1": b7) is turned OFF by removing the servo alarm factor of axis 2.

4) The warning ("[Md.108] Servo status1": b15) is turned OFF by "[Cd.5] Axis error reset" of axis 1.

# 10 PARAMETER SETTING

This chapter describes the parameter setting of the Simple Motion module. By setting parameters, the parameter setting by program is not needed.
The parameter setting has two types including the module parameter and Simple Motion module setting.

## 10.1 Parameter Setting Procedure

***1.*** Add the Simple Motion module to the engineering tool.

[Navigation] ⇨ [Parameter] ⇨ [Module Information] ⇨ Right-click ⇨ [Add New Module]

***2.*** The parameter setting has two types including the module parameter and Simple Motion module setting. Select either of them from the tree on the following window.

[Navigation] ⇨ [Parameter] ⇨ [Module Information] ⇨ Target module

***3.*** Write the settings to the CPU module with the engineering tool.

[Online] ⇨ [Write to PLC]

***4.*** The settings are reflected by resetting the CPU module or powering off and on the system.

## 10.2 Module Parameters

Set the module parameter. The module parameter has the refresh setting.
Select the module parameter from the tree on the following window.

[Navigation] ⇨ [Parameter] ⇨ [Module Information] ⇨ Target module ⇨ [Module Parameter]

### Refresh settings

Configure the setting to transfer the values in the buffer memory of the Simple Motion module to devices or module labels in the CPU module. By configuring these refresh settings, reading the data by program is not needed.
Select the transfer destination from the following at "Target".

- Module Label (☞ Page 352 Module Label)
- Refresh Data Register (RD) (☞ Page 352 Refresh Data Register (RD))
- Device (☞ Page 352 Device)

#### Module Label

Transfer the setting of the buffer memory to the corresponding module label of each buffer memory area. Setting "Current feed value" of the axis to be transferred to the module label to "Enable" sets all the items of the set axis to "Enable".

#### Refresh Data Register (RD)

Transfer the setting of the buffer memory to the refresh data register (RD) of the CPU module. All transfer destinations are automatically set by setting the top device to "Top Device Name".

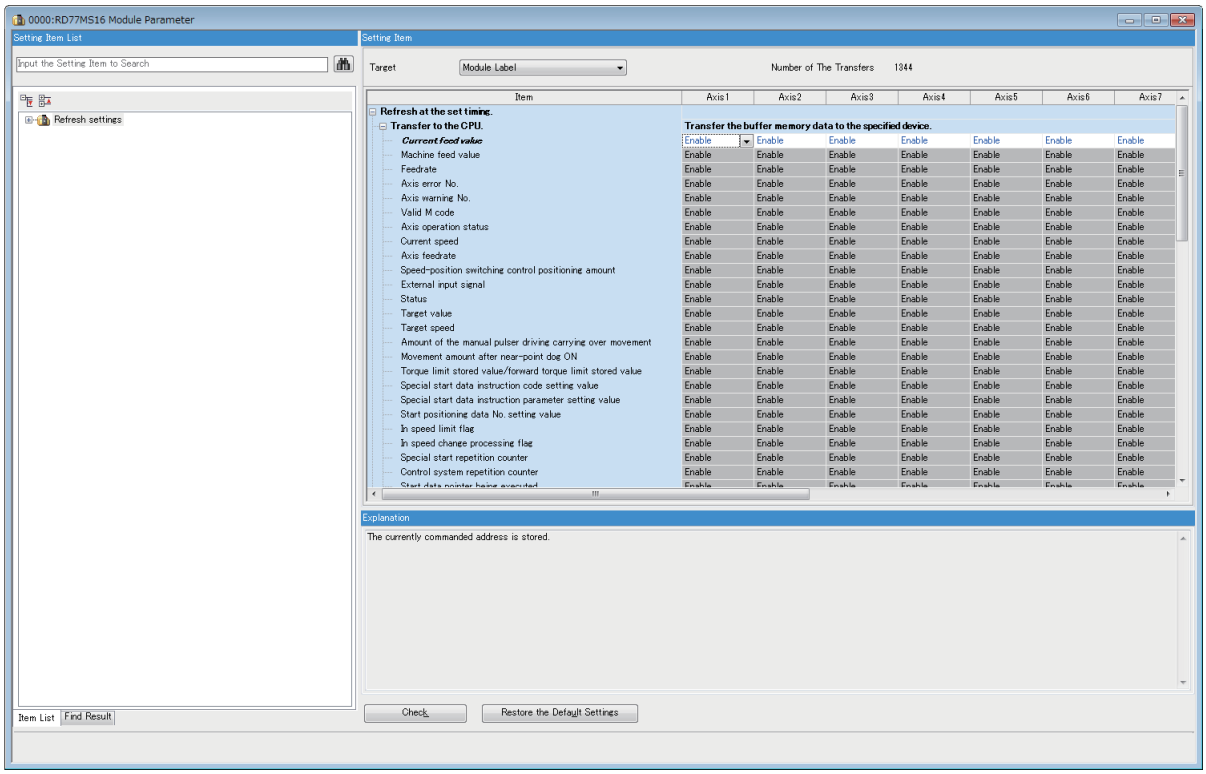
#### Device

Transfer the setting of the buffer memory to the specified device of the CPU module. The device X, Y, M, L, B, D, W, R, ZR, and RD can be specified. To use the bit device X, Y, M, L, or B, set a number which is divisible by 16 points (example: X10, Y120, M16). The data in the buffer memory is stored in devices for 16 points from the set number.

**Ex.**
When X10 is set, data is stored in X10 to X1F.

## Setting item

The refresh setting has the following items.




| Item | | | Reference |
|---|---|---|---|
| Refresh at the set timing. | Transfer to the CPU. | Current feed value | Page 478 [Md.20] Current feed value |
| | | Machine feed value | Page 479 [Md.21] Machine feed value |
| | | Feedrate | Page 479 [Md.22] Feedrate |
| | | Axis error No. | Page 479 [Md.23] Axis error No. |
| | | Axis warning No. | Page 480 [Md.24] Axis warning No. |
| | | Valid M code | Page 480 [Md.25] Valid M code |
| | | Axis operation status | Page 480 [Md.26] Axis operation status |
| | | Current speed | Page 481 [Md.27] Current speed |
| | | Axis feedrate | Page 482 [Md.28] Axis feedrate |
| | | Speed-position switching control positioning amount | Page 482 [Md.29] Speed-position switching control positioning movement amount |
| | | External input signal | Page 483 [Md.30] External input signal |
| | | Status | Page 483 [Md.31] Status |
| | | Target value | Page 485 [Md.32] Target value |
| | | Target speed | Page 486 [Md.33] Target speed |
| | | Amount of the manual pulser driving carrying over movement | Page 492 [Md.62] Amount of the manual pulser driving carrying over movement |
| | | Movement amount after near-point dog ON | Page 487 [Md.34] Movement amount after near-point dog ON |
| | | Torque limit stored value/forward torque limit stored value | Page 487 [Md.35] Torque limit stored value/forward torque limit stored value |
| | | Special start data instruction code setting value | Page 487 [Md.36] Special start data instruction code setting value |
| | | Special start data instruction parameter setting value | Page 488 [Md.37] Special start data instruction parameter setting value |
| | | Start positioning data No. setting value | Page 488 [Md.38] Start positioning data No. setting value |
| | | In speed limit flag | Page 488 [Md.39] In speed limit flag |
| | | In speed change processing flag | Page 489 [Md.40] In speed change processing flag |

| Item | | | Reference |
|---|---|---|---|
| Refresh at the set timing. | Transfer to the CPU. | Special start repetition counter | Page 489 [Md.41] Special start repetition counter |
| | | Control system repetition counter | Page 489 [Md.42] Control system repetition counter |
| | | Start data pointer being executed | Page 490 [Md.43] Start data pointer being executed |
| | | Positioning data No. being executed | Page 490 [Md.44] Positioning data No. being executed |
| | | Block No. being executed | Page 490 [Md.45] Block No. being executed |
| | | Last executed positioning data No. | Page 491 [Md.46] Last executed positioning data No. |
| | | Positioning data being executed (Positioning identifier) | Page 491 [Md.47] Positioning data being executed |
| | | Positioning data being executed (M code) | |
| | | Positioning data being executed (Dwell time) | |
| | | Positioning data being executed (Command speed) | |
| | | Positioning data being executed (Positioning address) | |
| | | Positioning data being executed (Arc address) | |
| | | Home position return re-travel value | Page 493 [Md.100] Home position return re-travel value |
| | | Real current value | Page 493 [Md.101] Real current value |
| | | Deviation counter value | Page 494 [Md.102] Deviation counter value |
| | | Motor rotation speed | Page 494 [Md.103] Motor rotation speed |
| | | Motor current value | Page 494 [Md.104] Motor current value |
| | | Servo status3 | Page 501 [Md.125] Servo status3 |
| | | Servo amplifier software No.1 | Page 495 [Md.106] Servo amplifier software No. |
| | | Servo amplifier software No.2 | |
| | | Servo amplifier software No.3 | |
| | | Servo amplifier software No.4 | |
| | | Servo amplifier software No.5 | |
| | | Servo amplifier software No.6 | |
| | | Parameter error No. | Page 495 [Md.107] Parameter error No. |
| | | Servo status2 | Page 499 [Md.119] Servo status2 |
| | | Servo status1 | Page 496 [Md.108] Servo status1 |
| | | Regenerative load ratio/Optional data monitor output 1 | Page 496 [Md.109] Regenerative load ratio/Optional data monitor output 1 |
| | | Effective load torque/Optional data monitor output 2 | Page 497 [Md.110] Effective load torque/Optional data monitor output 2 |
| | | Peak torque ratio/Optional data monitor output 3 | Page 497 [Md.111] Peak torque ratio/Optional data monitor output 3 |
| | | Optional data monitor output 4 | Page 497 [Md.112] Optional data monitor output 4 |
| | | Semi/Fully closed loop status | Page 498 [Md.113] Semi/Fully closed loop status |
| | | Servo alarm | Page 498 [Md.114] Servo alarm |
| | | Encoder option information | Page 499 [Md.116] Encoder option information |
| | | Reverse torque limit stored value | Page 500 [Md.120] Reverse torque limit stored value |
| | | Speed during command | Page 500 [Md.122] Speed during command |
| | | Torque during command | Page 501 [Md.123] Torque during command |
| | | Control mode switching status | Page 501 [Md.124] Control mode switching status |
| | | Positioning data being executed (Axis to be interpolated) | Page 491 [Md.47] Positioning data being executed |
| | | Deceleration start flag | Page 492 [Md.48] Deceleration start flag |
| | | Servo status7 | Page 502 [Md.500] Servo status7 |
| | | Driver operation alarm number | Page 502 [Md.502] Driver operation alarm number |
| | | Pre-reading data analysis status | Page 502 [Md.503] Pre-reading data analysis status |
| Refresh Group | | Refresh Group | Page 355 Refresh group |
| | | Group [n] (n: 1-64) | |
| Refresh Timing (I/O)*1 | | Refresh Timing | — |

*1 The setting cannot be changed from the default in the Simple Motion module.

### ■Refresh group

Set the refresh timing of the specified refresh destination.

| Setting value | Description |
|---|---|
| At the Execution Time of END Instruction | Performs refresh at END processing of the CPU module. |
| At the Execution Time of Specified Program | Performs refresh at the execution of the program specified with "Group [n] (n: 1-64)". |



## Refresh processing time

A refresh processing time [μs] is a constituent of the scan time of the CPU module. For details on the scan time, refer to the following.

MELSEC iQ-R CPU Module User's Manual (Application)

The refresh processing time [μs], which is taken for refresh processing, is given by:

- Refresh processing time [μs] = Refresh read time (refresh data transfer to the CPU module)

The refresh read time varies depending on the settings of "Target".

### ■When "Target" is a module label or a refresh data register (RD)

The following table shows the refresh read time with an R_CPU used.

| Classification | Number of the axis set | When using the refresh settings |
|---|---|---|
| Refresh read time | 1 | 22.58 μs |
| | 2 | 33.56 μs |
| | 3 | 44.54 μs |
| | 4 | 55.52 μs |
| | 5 | 66.50 μs |
| | 6 | 77.48 μs |
| | 7 | 88.46 μs |
| | 8 | 99.44 μs |
| | 9 | 110.42 μs |
| | 10 | 121.40 μs |
| | 11 | 132.38 μs |
| | 12 | 143.36 μs |
| | 13 | 154.34 μs |
| | 14 | 165.32 μs |
| | 15 | 176.30 μs |
| | 16 | 187.28 μs |

### ■When "Target" is a specified device

Calculate the refresh read time according to the number of items and the number of their transfer data (word) that are set to be refreshed. For the calculation method, refer to the following.

MELSEC iQ-R CPU Module User's Manual (Application)

In addition, substitute the following values in the calculation formula to calculate the refresh read time.

| Item | Description |
|---|---|
| Number of refresh settings | The number of items that are set to be refreshed |
| Refresh time (A) of each of the first to nth set items | 0.05 μs per one word of each of the first to nth set items*1 |

*1 This value is the time with an R_CPU used.

Ex.

If all the 1184 items (1344 words in total) of the RD77MS16 are set in the refresh read settings

1184 × 0.98 + 0.05 × 1344 + 11.6 = 1239.12 μs

The refresh read time, therefore, is 1239.12 μs.

# 10.3 Simple Motion Module Setting

Set the required setting for the Simple Motion module. Refer to the "Simple Motion Module Setting Function Help" of the engineering tool for details.

Select the Simple Motion module setting from the tree on the following window.

[Navigation] ⇨ [Parameter] ⇨ [Module Information] ⇨ Target module ⇨ [Simple Motion module setting]

# 11 SPECIFICATIONS OF I/O SIGNALS WITH CPU MODULES

## 11.1 List of Input/Output Signals with CPU Modules



The Simple Motion module uses 32 input points and 32 output points for exchanging data with the CPU module.
The input/output signals of the Simple Motion module are shown below.

**Point**

- The following input/output numbers (X/Y) are shown in the case that the start input/output number of the Simple Motion module is 0.
- The use prohibited signals are used by the system, and cannot be used by a customer. If these devices are used, the function of the Simple Motion module will not be guaranteed.

| Signal direction: Simple Motion module → CPU module | | |
|---|---|---|
| **Device No.** | **Signal name** | |
| X0 | READY | |
| X1 | Synchronization flag | |
| X2 | Use prohibited | |
| X3 | | |
| X4 | | |
| X5 | | |
| X6 | | |
| X7 | | |
| X8 | | |
| X9 | | |
| XA | | |
| XB | | |
| XC | | |
| XD | | |
| XE | | |
| XF | | |
| X10 | Axis 1 | BUSY*1 |
| X11 | Axis 2 | |
| X12 | Axis 3 | |
| X13 | Axis 4 | |
| X14 | Axis 5 | |
| X15 | Axis 6 | |
| X16 | Axis 7 | |
| X17 | Axis 8 | |
| X18 | Axis 9 | |
| X19 | Axis 10 | |
| X1A | Axis 11 | |
| X1B | Axis 12 | |
| X1C | Axis 13 | |
| X1D | Axis 14 | |
| X1E | Axis 15 | |
| X1F | Axis 16 | |

| Signal direction: CPU module → Simple Motion module | | |
|---|---|---|
| **Device No.** | **Signal name** | |
| Y0 | PLC READY | |
| Y1 | All axis servo ON | |
| Y2 | Use prohibited | |
| Y3 | | |
| Y4 | | |
| Y5 | | |
| Y6 | | |
| Y7 | | |
| Y8 | | |
| Y9 | | |
| YA | | |
| YB | | |
| YC | | |
| YD | | |
| YE | | |
| YF | | |
| Y10 | Axis 1 | Positioning start*1 |
| Y11 | Axis 2 | |
| Y12 | Axis 3 | |
| Y13 | Axis 4 | |
| Y14 | Axis 5 | |
| Y15 | Axis 6 | |
| Y16 | Axis 7 | |
| Y17 | Axis 8 | |
| Y18 | Axis 9 | |
| Y19 | Axis 10 | |
| Y1A | Axis 11 | |
| Y1B | Axis 12 | |
| Y1C | Axis 13 | |
| Y1D | Axis 14 | |
| Y1E | Axis 15 | |
| Y1F | Axis 16 | |

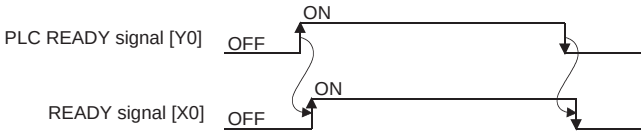
*1 The BUSY signal and positioning start signal, whose axis numbers exceed the number of controlled axes, cannot be used.

**Point**

- The M code ON signal, error detection signal, start complete signal and positioning complete signal are assigned to the bit of "[Md.31] Status".
- The axis stop signal, forward run JOG start signal, reverse run JOG start signal, execution prohibition flag are assigned to the buffer memory [Cd.180] to [Cd.183].

# 11.2 Details of Input Signals

The ON/OFF timing and conditions of the input signals are shown below.

| Device No. | Signal name | | | Details |
|---|---|---|---|---|
| X0 | READY | | ON: READY<br>OFF: Not READY/Watch dog timer error | • When the PLC READY signal [Y0] turns from OFF to ON, the parameter setting range is checked. If no error is found, this signal turns ON.<br>• When the PLC READY signal [Y0] turns OFF, this signal turns OFF.<br>• When watch dog timer error occurs, this signal turns OFF.<br>• This signal is used for interlock in a program, etc.<br>  |
| X1 | Synchronization flag | | OFF: Module access disabled<br>ON: Module access enabled | • After the CPU module is turned ON or the CPU module is reset, this signal turns ON if the access from the CPU module to the Simple Motion module is possible.<br>• When "Asynchronous" is selected in the module synchronization setting of the CPU module, this signal can be used as interlock for the access from a program to the Simple Motion module. |
| X10<br>X11<br>X12<br>X13<br>X14<br>X15<br>X16<br>X17<br>X18<br>X19<br>X1A<br>X1B<br>X1C<br>X1D<br>X1E<br>X1F | Axis 1<br>Axis 2<br>Axis 3<br>Axis 4<br>Axis 5<br>Axis 6<br>Axis 7<br>Axis 8<br>Axis 9<br>Axis 10<br>Axis 11<br>Axis 12<br>Axis 13<br>Axis 14<br>Axis 15<br>Axis 16 | BUSY*1 | OFF: Not BUSY<br>ON: BUSY | • This signal turns ON at the start of positioning, home position return or JOG operation. It turns OFF when the "[Da.9] Dwell time/JUMP destination positioning data No." has passed after positioning stops. (This signal remains ON during positioning.)<br>• This signal turns OFF when the positioning is stopped with step operation.<br>• During manual pulse generator operation, this signal turns ON while the "[Cd.21] Manual pulse generator enable flag" is ON.<br>• This signal turns OFF at error completion or positioning stop. |

*1 The BUSY signal, whose axis number exceeds the number of controlled axes, cannot be used.

**Point**

The BUSY signal turns ON even when position control of movement amount 0 is executed. However, since the ON time is short, the ON status may not to be detected in the program.

# 11.3 Details of Output Signals

The ON/OFF timing and conditions of the output signals are shown below.

| Device No. | Signal name | | | Details |
|---|---|---|---|---|
| Y0 | PLC READY | | OFF: PLC READY OFF<br>ON: PLC READY ON | (a) This signal notifies the Simple Motion module that the CPU module is normal.<br>• It is turned ON/OFF with the program.<br>(b) When the data (parameter, etc.) are changed, this signal is turned OFF depending on the parameter. (☞ Page 542 Memory Configuration and Data Process)<br>(c)The following processes are carried out when this signal turns from OFF to ON.<br>• The parameter setting range is checked.<br>• The READY signal [X0] turns ON.<br>(d) The following processes are carried out when this signal turns from ON to OFF. In these cases, the OFF time should be set to 100 ms or more.<br>• The READY signal [X0] turns OFF.<br>• The operating axis stops.<br>• The M code ON signal ([Md.31] Status: b12) for each axis turns OFF, and "0" is stored in "[Md.25] Valid M code".<br>(e) When parameters or positioning data (No. 1 to 600) are written from the engineering tool or CPU module to the flash ROM, this signal will turn OFF. |
| Y1 | All axis servo ON | | OFF: Servo OFF<br>ON: Servo ON | • The servo for all the servo amplifiers connected to the Simple Motion module is turned ON or OFF. |
| Y10<br>Y11<br>Y12<br>Y13<br>Y14<br>Y15<br>Y16<br>Y17<br>Y18<br>Y19<br>Y1A<br>Y1B<br>Y1C<br>Y1D<br>Y1E<br>Y1F | Axis 1<br>Axis 2<br>Axis 3<br>Axis 4<br>Axis 5<br>Axis 6<br>Axis 7<br>Axis 8<br>Axis 9<br>Axis 10<br>Axis 11<br>Axis 12<br>Axis 13<br>Axis 14<br>Axis 15<br>Axis 16 | Positioning start*1 | OFF: Positioning start not requested<br>ON: Positioning start requested | • Home position return operation or positioning operation is started.<br>• The positioning start signal is valid at the rising edge, and the operation is started.<br>• When this signal turns ON during BUSY, the warning "Start during operation" (warning code: 0900H) will occur. |

*1 The positioning signal, whose axis number exceeds the number of controlled axes, cannot be used.

# 12 DATA USED FOR POSITIONING CONTROL

The parameters and data used to carry out positioning control with the Simple Motion module are explained in this chapter. With the positioning system using the Simple Motion module, the various parameters and data explained in this chapter are used for control. The parameters and data include parameters set according to the device configuration, such as the system configuration, and parameters and data set according to each control.
Read this section thoroughly and make settings according to each control or application.

## 12.1 Types of Data



### Parameters and data required for control

The parameters and data required to carry out control with the Simple Motion module include the "setting data", "monitor data" and "control data" shown below.

#### Setting data

The data is set beforehand according to the machine and application. Set the data with programs or engineering tools. The data set for the buffer memory can also be saved in the flash ROM or internal memory (nonvolatile) in the Simple Motion module.

**Restriction**

The setting data can be backed up only in the flash ROM/internal memory (nonvolatile) of the Simple Motion module. It cannot be backed up in the CPU module and the SD memory card mounted to the CPU module.

The setting data is classified as follows.

| Classification | | Item | Description |
|---|---|---|---|
| Parameters | Servo network composition parameters | | Parameters for the network.<br>Set the device to be used and the network according to the system configuration. |
| | Common parameters | | Parameters that are independent of axes and related to the overall system.<br>Set according to the system configuration when the system is started up. |
| | Positioning parameters | Basic parameters 1*1 | Set according to the machine and applicable motor when the system is started up. |
| | | Basic parameters 2 | |
| | | Detailed parameters 1 | Set according to the system configuration when the system is started up. |
| | | Detailed parameters 2*2 | |
| | Home position return parameters | Home position return basic parameters | Set the values required for carrying out home position return control. |
| | | Home position return detailed parameters | |
| | Expansion parameters | | Set according to the system configuration when the system is started up. |
| | Servo parameters | Servo amplifier parameters (PA, PB, PC, PD, PE, PS, PF, Po, PL) | Set the data that is determined by the specification of the servo being used when the system is started up. |
| Positioning data | Positioning data | | Set the data for "major positioning control". |
| Block start data | Block start data | | Set the block start data for "high-level positioning control". |
| | Condition data | | Set the condition data for "high-level positioning control". |
| | Memo data | | Set the condition judgment values for the condition data used in "high-level positioning control". |
| Synchronous control data | | | Set the data for synchronous control. |

*1 If the setting of the basic parameters 1 is incorrect, the rotation direction may be reversed, or no operation may take place.
*2 Detailed parameters 2 are data items for using the functions of Simple Motion module to the fullest. Set as required.

- The following methods are available for data setting. In this manual, the method using the engineering tool will be explained. (Refer to the next "Point".)

  - Set using the engineering tool.
  - Create the program for data setting using the engineering tool and execute it.

- The basic parameters 1, detailed parameters 1, home position return parameters, "[Pr.83] Speed control 10 × multiplier setting for degree axis", "[Pr.89] Manual pulse generator/Incremental synchronous encoder input type selection", "[Pr.90] Operation setting for speed-torque control mode" and "[Pr.95] External command signal selection" become valid when the PLC READY signal [Y0] turns from OFF to ON.
- The basic parameters 2, detailed parameters 2 (Note that this excludes "[Pr.83] Speed control 10 × multiplier setting for degree axis", "[Pr.90] Operation setting for speed-torque control mode", "[Pr.95] External command signal selection", "[Pr.122] Manual pulse generator speed limit mode" and "[Pr.123] Manual pulse generator speed limit value".) become valid immediately when they are written to the buffer memory, regardless of the state of the PLC READY signal [Y0].
- Even when the PLC READY signal [Y0] is ON, the values or contents of the following can be changed: basic parameters 2, detailed parameters 2, positioning data, and block start data.
- The servo parameter is transmitted from the Simple Motion module to the servo amplifier when the initialized communication carried out after the power supply is turned ON or the CPU module is reset. The power supply is turned ON or the CPU module is reset after writing servo parameter in flash ROM of Simple Motion module if the servo parameter is transmitted to the servo amplifier.
- The only valid data assigned to basic parameter 2, detailed parameter 2, positioning data or block start data are the data read at the moment when a positioning or JOG operation is started. Once the operation has started, any modification to the data is ignored. Exceptionally, however, modifications to the following are valid even when they are made during a positioning operation: acceleration time 0 to 3, deceleration time 0 to 3, and external command function.

| Setting data that can be changed during operation | Details |
|---|---|
| Acceleration time 0 to 3, deceleration time 0 to 3 | Positioning data are pre-read and pre-analyzed. Modifications to the data four or more steps after the current step are valid. |
| External command function selection | The value at the time of detection is valid. |

**Point**

- The "setting data" is created for each axis.
- The "setting data" parameters have determined default values, and are set to the default values before shipment from the factory. (Parameters related to axes that are not used are left at the default value.)
- The "setting data" can be initialized with the engineering tool or the program.
- It is recommended to set the "setting data" with the engineering tool. The program for data setting is complicated and many devices must be used. This will increase the scan time.

## Monitor data

The data indicates the control status. The data is stored in the buffer memory. Monitor the data as necessary.
The setting data is classified as follows.

| Item | Description |
|---|---|
| System monitor data | Monitors the specifications and the operation history of Simple Motion module. |
| Axis monitor data | Monitors the data related to the operating axis, such as the current position and speed. |
| Servo network composition status | Monitors the data related to the current network state. |
| Synchronous control data | Monitors the data for synchronous control. |

- The following methods are available for data monitoring:

  - Set using the engineering tool.
  - Create the program for monitoring using the engineering tool and execute it.

- In this manual, the method using the engineering tool will be explained.

## Control data

The data is used by users to control the positioning system.

The setting data is classified as follows.

| Item | Description |
|---|---|
| System control data | Writes/initializes the "positioning data" in the module.<br>Sets the setting for operation of all axes. |
| Axis control data | Makes settings related to the operation, and controls the speed change during operation, and stops/restarts the operation for each axis.<br>Output signals (axis stop signal, JOG start signal and execution prohibition flag) from the CPU module to the Simple Motion module. |
| Synchronous control data | Sets the data for synchronous control. |

- Control using the control data is carried out with the program. "[Cd.41] Deceleration start flag valid" is valid for only the value at the time when the PLC READY signal [Y0] turns from OFF to ON.



# Setting items for servo network composition parameters

The setting items for the "servo network composition parameters" are shown below.

| Servo network composition parameter | | Remark |
|---|---|---|
| [Pr.100] | Connected device | Sets the SSCNET device to be connected with the Simple Motion module. |

# Setting items for common parameters

The setting items for the "common parameters" are shown below. The "common parameters" are independent of axes and related to the overall system.

◎: Always set

○: Set as required ("—" when not required)

×: Setting not possible

△: Setting restricted

—: Setting not required (The setting value is invalid. When the value is the default value or within the setting range, there is no problem.)

| Common parameter | | Home position return control | Major positioning control | | | |
|---|---|---|---|---|---|---|
| | | | Position control | | | |
| | | | 1-axis linear control 2/3/4-axis linear interpolation control | 1/2/3/4-axis fixed-feed control | 2-axis circular interpolation control | 3-axis helical interpolation control |
| [Pr.24] | Manual pulse generator/Incremental synchronous encoder input selection | — | — | — | — | — |
| [Pr.82] | Forced stop valid/invalid selection | ○ | ○ | ○ | ○ | ○ |
| [Pr.89] | Manual pulse generator/Incremental synchronous encoder input type selection | — | — | — | — | — |
| [Pr.96] | Operation cycle setting | — | — | — | — | — |
| [Pr.97] | SSCNET setting | — | — | — | — | — |
| [Pr.150] | Input terminal logic selection | ○ | ○ | ○ | ○ | ○ |
| [Pr.151] | Manual pulse generator/Incremental synchronous encoder input logic selection | — | — | — | — | — |
| [Pr.152] | Maximum number of control axes | ○ | ○ | ○ | ○ | ○ |
| [Pr.153] | External input signal digital filter setting | ○ | ○ | ○ | ○ | ○ |

◎: Always set

○: Set as required ("—" when not required)

×: Setting not possible

△: Setting restricted

—: Setting not required (The setting value is invalid. When the value is the default value or within the setting range, there is no problem.)

| Common parameter | | Major positioning control | | | |
|---|---|---|---|---|---|
| | | 1 to 4 axis speed control | Speed-position or position-speed control | Other control | |
| | | | | Current value changing | JUMP instruction, NOP instruction, LOOP to LEND |
| [Pr.24] | Manual pulse generator/Incremental synchronous encoder input selection | — | — | — | — |
| [Pr.82] | Forced stop valid/invalid selection | ○ | ○ | ○ | ○ |
| [Pr.89] | Manual pulse generator/Incremental synchronous encoder input type selection | — | — | — | — |
| [Pr.96] | Operation cycle setting | — | — | — | — |
| [Pr.97] | SSCNET setting | — | — | — | — |
| [Pr.150] | Input terminal logic selection | ○ | ○ | ○ | ○ |
| [Pr.151] | Manual pulse generator/Incremental synchronous encoder input logic selection | — | — | — | — |
| [Pr.152] | Maximum number of control axes | ○ | ○ | ○ | ○ |
| [Pr.153] | External input signal digital filter setting | ○ | ○ | ○ | ○ |

◎: Always set
○: Set as required ("—" when not required)
×: Setting not possible
△: Setting restricted
—: Setting not required (The setting value is invalid. When the value is the default value or within the setting range, there is no problem.)

| Common parameter | | Manual control | | | Expansion control | Related sub function |
|---|---|---|---|---|---|---|
| | | Manual pulse generator operation | Inching operation | JOG operation | Speed-torque control | |
| [Pr.24] | Manual pulse generator/Incremental synchronous encoder input selection | ◎ | — | — | — | — |
| [Pr.82] | Forced stop valid/invalid selection | ○ | ○ | ○ | ○ | ☞ Page 246 Forced stop function |
| [Pr.89] | Manual pulse generator/Incremental synchronous encoder input type selection | ◎ | — | — | — | — |
| [Pr.96] | Operation cycle setting | — | — | — | — | — |
| [Pr.97] | SSCNET setting | — | — | — | — | — |
| [Pr.150] | Input terminal logic selection | ○ | ○ | ○ | ○ | — |
| [Pr.151] | Manual pulse generator/Incremental synchronous encoder input logic selection | ◎ | — | — | — | — |
| [Pr.152] | Maximum number of control axes | ○ | ○ | ○ | ○ | — |
| [Pr.153] | External input signal digital filter setting | ○ | ○ | ○ | ○ | — |

# Setting items for positioning parameters

The setting items for the "positioning parameters" are shown below. The "positioning parameters" are set for each axis for all controls achieved by the Simple Motion module.

## Home position return control

◎: Always set, ○: Set as required ("—" when not required), △: Setting restricted, ×: Setting not possible

—: Setting not required (The setting value is invalid. When the value is the default value or within the setting range, there is no problem.)

| Positioning parameter | | Home position return control |
|---|---|---|
| Basic parameters 1 | [Pr.1] Unit setting | ◎ |
| | [Pr.2] Number of pulses per rotation (AP) (Unit: pulse) | ◎ |
| | [Pr.3] Movement amount per rotation (AL) | ◎ |
| | [Pr.4] Unit magnification (AM) | ◎ |
| | [Pr.7] Bias speed at start | ○ |
| Basic parameters 2 | [Pr.8] Speed limit value | ◎ |
| | [Pr.9] Acceleration time 0 | ◎ |
| | [Pr.10] Deceleration time 0 | ◎ |
| Detailed parameters 1 | [Pr.11] Backlash compensation amount | ○ |
| | [Pr.12] Software stroke limit upper limit value | — |
| | [Pr.13] Software stroke limit lower limit value | — |
| | [Pr.14] Software stroke limit selection | — |
| | [Pr.15] Software stroke limit valid/invalid setting | — |
| | [Pr.16] Command in-position width | — |
| | [Pr.17] Torque limit setting value | △ |
| | [Pr.18] M code ON signal output timing | — |
| | [Pr.19] Speed switching mode | — |
| | [Pr.20] Interpolation speed designation method | — |
| | [Pr.21] Current feed value during speed control | — |
| | [Pr.22] Input signal logic selection | ◎ |
| | [Pr.81] Speed-position function selection | — |
| | [Pr.116] FLS signal selection | ○ |
| | [Pr.117] RLS signal selection | ○ |
| | [Pr.118] DOG signal selection | ○ |
| | [Pr.119] STOP signal selection | ○ |

| Positioning parameter | | Home position return control |
|---|---|---|
| Detailed parameters 2 | [Pr.25] Acceleration time 1 | ○ |
| | [Pr.26] Acceleration time 2 | ○ |
| | [Pr.27] Acceleration time 3 | ○ |
| | [Pr.28] Deceleration time 1 | ○ |
| | [Pr.29] Deceleration time 2 | ○ |
| | [Pr.30] Deceleration time 3 | ○ |
| | [Pr.31] JOG speed limit value | — |
| | [Pr.32] JOG operation acceleration time selection | — |
| | [Pr.33] JOG operation deceleration time selection | — |
| | [Pr.34] Acceleration/deceleration process selection | ○ |
| | [Pr.35] S-curve ratio | ○ |
| | [Pr.36] Sudden stop deceleration time | ○ |
| | [Pr.37] Stop group 1 sudden stop selection | ○ |
| | [Pr.38] Stop group 2 sudden stop selection | ○ |
| | [Pr.39] Stop group 3 sudden stop selection | ○ |
| | [Pr.40] Positioning complete signal output time | — |
| | [Pr.41] Allowable circular interpolation error width | — |
| | [Pr.42] External command function selection | ○ |
| | [Pr.83] Speed control 10 × multiplier setting for degree axis | ○ |
| | [Pr.84] Restart allowable range when servo OFF to ON | ○ |
| | [Pr.90] Operation setting for speed-torque control mode | — |
| | [Pr.95] External command signal selection | ○ |
| | [Pr.122] Manual pulse generator speed limit mode | — |
| | [Pr.123] Manual pulse generator speed limit value | — |

## Major positioning control

◎: Always set, ○: Set as required ("—" when not required), △: Setting restricted, ×: Setting not possible

—: Setting not required (The setting value is invalid. When the value is the default value or within the setting range, there is no problem.)

| Positioning parameter | | Major positioning control | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Position control | | | | 1 to 4 axis speed control | Speed-position or position-speed control | Other control | |
| | | 1-axis linear control 2/3/4-axis linear interpolation control | 1/2/3/4-axis fixed-feed control | 2-axis circular interpolation control | 3-axis helical interpolation control | | | Current value changing | JUMP instruction, NOP instruction, LOOP to LEND |
| Basic parameters 1 | [Pr.1] Unit setting | ◎ | ◎ | △ | △ | ◎ | ◎ | ◎ | ◎ |
| | [Pr.2] Number of pulses per rotation (AP) (Unit: pulse) | ◎ | ◎ | ◎ | ◎ | ◎ | ◎ | ◎ | ◎ |
| | [Pr.3] Movement amount per rotation (AL) | ◎ | ◎ | ◎ | ◎ | ◎ | ◎ | ◎ | ◎ |
| | [Pr.4] Unit magnification (AM) | ◎ | ◎ | ◎ | ◎ | ◎ | ◎ | ◎ | ◎ |
| | [Pr.7] Bias speed at start | ○ | ○ | ○ | ○ | ○ | ○ | — | — |
| Basic parameters 2 | [Pr.8] Speed limit value | ◎ | ◎ | ◎ | ◎ | ◎ | ◎ | — | — |
| | [Pr.9] Acceleration time 0 | ◎ | ◎ | ◎ | ◎ | ◎ | ◎ | — | — |
| | [Pr.10] Deceleration time 0 | ◎ | ◎ | ◎ | ◎ | ◎ | ◎ | — | — |

| Positioning parameter | | Major positioning control | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Position control | | | | 1 to 4 axis speed control | Speed-position or position-speed control | Other control | |
| | | 1-axis linear control 2/3/4-axis linear interpolation control | 1/2/3/4-axis fixed-feed control | 2-axis circular interpolation control | 3-axis helical interpolation control | | | Current value changing | JUMP instruction, NOP instruction, LOOP to LEND |
| Detailed parameters 1 | [Pr.11] Backlash compensation amount | ○ | ○ | ○ | ○ | ○ | ○ | — | — |
| | [Pr.12] Software stroke limit upper limit value | ○ | ○ | ○ | ○ | ○ | ○ | — | — |
| | [Pr.13] Software stroke limit lower limit value | ○ | ○ | ○ | ○ | ○ | ○ | — | — |
| | [Pr.14] Software stroke limit selection | ○ | ○ | ○ | ○ | ○ | ○ | — | — |
| | [Pr.15] Software stroke limit valid/invalid setting | — | — | — | — | — | — | ○ | ○ |
| | [Pr.16] Command in-position width | ○ | ○ | ○ | ○ | — | ○ | — | — |
| | [Pr.17] Torque limit setting value | ○ | ○ | ○ | ○ | ○ | ○ | — | — |
| | [Pr.18] M code ON signal output timing | ○ | ○ | ○ | ○ | ○ | ○ | ○ | — |
| | [Pr.19] Speed switching mode | ○ | ○ | ○ | ○ | — | — | — | — |
| | [Pr.20] Interpolation speed designation method | △ | △ | △ | △ | △ | — | — | — |
| | [Pr.21] Current feed value during speed control | — | — | — | — | ○ | ○ | — | — |
| | [Pr.22] Input signal logic selection | ◎ | ◎ | ◎ | ◎ | ◎ | ◎ | ◎ | ◎ |
| | [Pr.81] Speed-position function selection | — | — | — | — | — | ◎ | — | — |
| | [Pr.116] FLS signal selection | ○ | ○ | ○ | ○ | ○ | ○ | — | — |
| | [Pr.117] RLS signal selection | ○ | ○ | ○ | ○ | ○ | ○ | — | — |
| | [Pr.118] DOG signal selection | — | — | — | ○ | — | ○ | — | — |
| | [Pr.119] STOP signal selection | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |

| Positioning parameter | | Major positioning control | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Position control | | | | 1 to 4 axis speed control | Speed-position or position-speed control | Other control | |
| | | 1-axis linear control 2/3/4-axis linear interpolation control | 1/2/3/4-axis fixed-feed control | 2-axis circular interpolation control | 3-axis helical interpolation control | | | Current value changing | JUMP instruction, NOP instruction, LOOP to LEND |
| Detailed parameters 2 | [Pr.25] Acceleration time 1 | ○ | ○ | ○ | ○ | ○ | ○ | — | — |
| | [Pr.26] Acceleration time 2 | ○ | ○ | ○ | ○ | ○ | ○ | — | — |
| | [Pr.27] Acceleration time 3 | ○ | ○ | ○ | ○ | ○ | ○ | — | — |
| | [Pr.28] Deceleration time 1 | ○ | ○ | ○ | ○ | ○ | ○ | — | — |
| | [Pr.29] Deceleration time 2 | ○ | ○ | ○ | ○ | ○ | ○ | — | — |
| | [Pr.30] Deceleration time 3 | ○ | ○ | ○ | ○ | ○ | ○ | — | — |
| | [Pr.31] JOG speed limit value | — | — | — | — | — | — | — | — |
| | [Pr.32] JOG operation acceleration time selection | — | — | — | — | — | — | — | — |
| | [Pr.33] JOG operation deceleration time selection | — | — | — | — | — | — | — | — |
| | [Pr.34] Acceleration/ deceleration process selection | ○ | ○ | ○ | ○ | ○ | ○ | — | — |
| | [Pr.35] S-curve ratio | ○ | ○ | ○ | ○ | ○ | ○ | — | — |
| | [Pr.36] Sudden stop deceleration time | ○ | ○ | ○ | ○ | ○ | ○ | — | — |
| | [Pr.37] Stop group 1 sudden stop selection | ○ | ○ | ○ | ○ | ○ | ○ | — | — |
| | [Pr.38] Stop group 2 sudden stop selection | ○ | ○ | ○ | ○ | ○ | ○ | — | — |
| | [Pr.39] Stop group 3 sudden stop selection | ○ | ○ | ○ | ○ | ○ | ○ | — | — |
| | [Pr.40] Positioning complete signal output time | ○ | ○ | ○ | ○ | ○ | ○ | ○ | — |

| Positioning parameter | | Major positioning control | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Position control | | | | 1 to 4 axis speed control | Speed-position or position-speed control | Other control | |
| | | 1-axis linear control 2/3/4-axis linear interpolation control | 1/2/3/4-axis fixed-feed control | 2-axis circular interpolation control | 3-axis helical interpolation control | | | Current value changing | JUMP instruction, NOP instruction, LOOP to LEND |
| Detailed parameters 2 | [Pr.41] Allowable circular interpolation error width | — | — | ○ | ○ | — | — | — | — |
| | [Pr.42] External command function selection | ○ | ○ | ○ | ○ | ○ | ◎ | ○ | — |
| | [Pr.83] Speed control 10 × multiplier setting for degree axis | ○ | ○ | ○ | ○ | ○ | ○ | — | — |
| | [Pr.84] Restart allowable range when servo OFF to ON | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| | [Pr.90] Operation setting for speed-torque control mode | — | — | — | — | — | — | — | — |
| | [Pr.95] External command signal selection | ○ | ○ | ○ | ○ | ○ | ◎ | ○ | — |
| | [Pr.122] Manual pulse generator speed limit mode | — | — | — | — | — | — | — | — |
| | [Pr.123] Manual pulse generator speed limit value | — | — | — | — | — | — | — | — |

## Manual control

◎: Always set, ○: Set as required ("—" when not required), △: Setting restricted, ×: Setting not possible

—: Setting not required (The setting value is invalid. When the value is the default value or within the setting range, there is no problem.)

| Positioning parameter | | Manual control | | |
|---|---|---|---|---|
| | | Manual pulse generator operation | Inching operation | JOG operation |
| Basic parameters 1 | [Pr.1] Unit setting | ◎ | ◎ | ◎ |
| | [Pr.2] Number of pulses per rotation (AP) (Unit: pulse) | ◎ | ◎ | ◎ |
| | [Pr.3] Movement amount per rotation (AL) | ◎ | ◎ | ◎ |
| | [Pr.4] Unit magnification (AM) | ◎ | ◎ | ◎ |
| | [Pr.7] Bias speed at start | — | — | ○ |
| Basic parameters 2 | [Pr.8] Speed limit value | — | ◎ | ◎ |
| | [Pr.9] Acceleration time 0 | — | — | ◎ |
| | [Pr.10] Deceleration time 0 | — | — | ◎ |
| Detailed parameters 1 | [Pr.11] Backlash compensation amount | ○ | ○ | ○ |
| | [Pr.12] Software stroke limit upper limit value | ○ | ○ | ○ |
| | [Pr.13] Software stroke limit lower limit value | ○ | ○ | ○ |
| | [Pr.14] Software stroke limit selection | ○ | ○ | ○ |
| | [Pr.15] Software stroke limit valid/invalid setting | ○ | ○ | ○ |
| | [Pr.16] Command in-position width | — | — | — |
| | [Pr.17] Torque limit setting value | △ | △ | △ |
| | [Pr.18] M code ON signal output timing | — | — | — |
| | [Pr.19] Speed switching mode | — | — | — |
| | [Pr.20] Interpolation speed designation method | — | — | — |
| | [Pr.21] Current feed value during speed control | — | — | — |
| | [Pr.22] Input signal logic selection | ◎ | ◎ | ◎ |
| | [Pr.81] Speed-position function selection | — | — | — |
| | [Pr.116] FLS signal selection | ○ | ○ | ○ |
| | [Pr.117] RLS signal selection | ○ | ○ | ○ |
| | [Pr.118] DOG signal selection | — | — | — |
| | [Pr.119] STOP signal selection | ○ | ○ | ○ |

| Positioning parameter | | Manual control | | |
|---|---|---|---|---|
| | | Manual pulse generator operation | Inching operation | JOG operation |
| Detailed parameters 2 | [Pr.25] Acceleration time 1 | — | — | ○ |
| | [Pr.26] Acceleration time 2 | — | — | ○ |
| | [Pr.27] Acceleration time 3 | — | — | ○ |
| | [Pr.28] Deceleration time 1 | — | — | ○ |
| | [Pr.29] Deceleration time 2 | — | — | ○ |
| | [Pr.30] Deceleration time 3 | — | — | ○ |
| | [Pr.31] JOG speed limit value | — | ◎ | ◎ |
| | [Pr.32] JOG operation acceleration time selection | — | — | ◎ |
| | [Pr.33] JOG operation deceleration time selection | — | — | ◎ |
| | [Pr.34] Acceleration/deceleration process selection | — | — | ○ |
| | [Pr.35] S-curve ratio | — | — | ○ |
| | [Pr.36] Sudden stop deceleration time | — | — | ○ |
| | [Pr.37] Stop group 1 sudden stop selection | — | — | ○ |
| | [Pr.38] Stop group 2 sudden stop selection | — | — | ○ |
| | [Pr.39] Stop group 3 sudden stop selection | — | — | ○ |
| | [Pr.40] Positioning complete signal output time | — | — | — |
| | [Pr.41] Allowable circular interpolation error width | — | — | — |
| | [Pr.42] External command function selection | — | — | ○ |
| | [Pr.83] Speed control 10 × multiplier setting for degree axis | ○ | ○ | ○ |
| | [Pr.84] Restart allowable range when servo OFF to ON | ○ | ○ | ○ |
| | [Pr.90] Operation setting for speed-torque control mode | — | — | — |
| | [Pr.95] External command signal selection | — | — | ○ |
| | [Pr.122] Manual pulse generator speed limit mode | ○ | — | — |
| | [Pr.123] Manual pulse generator speed limit value | ○ | — | — |

## Expansion control

◎: Always set, ○: Set as required ("—" when not required), △: Setting restricted, ×: Setting not possible

—: Setting not required (The setting value is invalid. When the value is the default value or within the setting range, there is no problem.)

| Positioning parameter | | Expansion control |
|---|---|---|
| | | Speed-torque control |
| Basic parameters 1 | [Pr.1] Unit setting | ◎ |
| | [Pr.2] Number of pulses per rotation (AP) (Unit: pulse) | ◎ |
| | [Pr.3] Movement amount per rotation (AL) | ◎ |
| | [Pr.4] Unit magnification (AM) | ◎ |
| | [Pr.7] Bias speed at start | × |
| Basic parameters 2 | [Pr.8] Speed limit value | ◎ |
| | [Pr.9] Acceleration time 0 | — |
| | [Pr.10] Deceleration time 0 | — |
| Detailed parameters 1 | [Pr.11] Backlash compensation amount | — |
| | [Pr.12] Software stroke limit upper limit value | ○ |
| | [Pr.13] Software stroke limit lower limit value | ○ |
| | [Pr.14] Software stroke limit selection | ○ |
| | [Pr.15] Software stroke limit valid/invalid setting | — |
| | [Pr.16] Command in-position width | — |
| | [Pr.17] Torque limit setting value | ○ |
| | [Pr.18] M code ON signal output timing | — |
| | [Pr.19] Speed switching mode | — |
| | [Pr.20] Interpolation speed designation method | — |
| | [Pr.21] Current feed value during speed control | — |
| | [Pr.22] Input signal logic selection | ◎ |
| | [Pr.81] Speed-position function selection | — |
| | [Pr.116] FLS signal selection | ○ |
| | [Pr.117] RLS signal selection | ○ |
| | [Pr.118] DOG signal selection | — |
| | [Pr.119] STOP signal selection | ○ |

| Positioning parameter | | Expansion control |
|---|---|---|
| | | Speed-torque control |
| Detailed parameters 2 | [Pr.25] Acceleration time 1 | — |
| | [Pr.26] Acceleration time 2 | — |
| | [Pr.27] Acceleration time 3 | — |
| | [Pr.28] Deceleration time 1 | — |
| | [Pr.29] Deceleration time 2 | — |
| | [Pr.30] Deceleration time 3 | — |
| | [Pr.31] JOG speed limit value | — |
| | [Pr.32] JOG operation acceleration time selection | — |
| | [Pr.33] JOG operation deceleration time selection | — |
| | [Pr.34] Acceleration/deceleration process selection | — |
| | [Pr.35] S-curve ratio | — |
| | [Pr.36] Sudden stop deceleration time | — |
| | [Pr.37] Stop group 1 sudden stop selection | — |
| | [Pr.38] Stop group 2 sudden stop selection | — |
| | [Pr.39] Stop group 3 sudden stop selection | — |
| | [Pr.40] Positioning complete signal output time | — |
| | [Pr.41] Allowable circular interpolation error width | — |
| | [Pr.42] External command function selection | — |
| | [Pr.83] Speed control 10 × multiplier setting for degree axis | ○ |
| | [Pr.84] Restart allowable range when servo OFF to ON | — |
| | [Pr.90] Operation setting for speed-torque control mode | ○ |
| | [Pr.95] External command signal selection | — |
| | [Pr.122] Manual pulse generator speed limit mode | — |
| | [Pr.123] Manual pulse generator speed limit value | — |

## Checking the positioning parameters

[Pr.1] to [Pr.90], [Pr.95], [Pr.116] to [Pr.119], [Pr.122], [Pr.123] are checked with the following timing.

- When the "PLC READY signal [Y0]" output from the CPU module to the Simple Motion module changes from OFF to ON.

**Point**

"High-level positioning control" is carried out in combination with the "major positioning control".
Refer to the "major positioning control" parameter settings for details on the parameters required for "high-level positioning control".

# Setting items for home position return parameters

When carrying out "home position return control", the "home position return parameters" must be set. The setting items for the "home position return parameters" are shown below.

The "home position return parameters" are set for each axis.

◎: Always set

○: Set as required

—: Setting not required (The setting value is invalid. When the value is the default value or within the setting range, there is no problem.)

R: Set when using the "Home position return retry function" ("—" when not set)

S: Set when using the "Home position shift function" ("—" when not set)

| Home position return parameters | | | Machine home position return control | | | | | Fast home position return control |
|---|---|---|---|---|---|---|---|---|
| Home position return basic parameters | [Pr.43] | Home position return method | Near-point dog method | Count method 1 | Count method 2 | Data set method | Scale origin signal detection method | Preset parameters are used for machine home position return control. |
| | [Pr.44] | Home position return direction | ◎ | ◎ | ◎ | ◎ | ◎ | |
| | [Pr.45] | Home position address | ◎ | ◎ | ◎ | ◎ | ◎ | |
| | [Pr.46] | Home position return speed | ◎ | ◎ | ◎ | — | ◎ | |
| | [Pr.47] | Creep speed | ◎ | ◎ | ◎ | — | ◎ | |
| | [Pr.48] | Home position return retry | R | R | R | — | — | |
| Home position return detailed parameters | [Pr.50] | Setting for the movement amount after near-point dog ON | — | ◎ | ◎ | — | — | |
| | [Pr.51] | Home position return acceleration time selection | ◎ | ◎ | ◎ | — | ◎ | |
| | [Pr.52] | Home position return deceleration time selection | ◎ | ◎ | ◎ | — | ◎ | |
| | [Pr.53] | Home position shift amount | S | S | S | — | S | |
| | [Pr.54] | Home position return torque limit value | ○ | ○ | ○ | — | ○ | |
| | [Pr.55] | Operation setting for incompletion of home position return | ○ | ○ | ○ | ○ | ○ | — |
| | [Pr.56] | Speed designation during home position shift | S | S | S | — | S | Preset parameters are used for machine home position return control. |
| | [Pr.57] | Dwell time during home position return retry | R | R | R | — | — | |

## Checking the home position return parameters

[Pr.43] to [Pr.57] are checked with the following timing.

- When the "PLC READY signal [Y0]" output from the CPU module to the Simple Motion module changes from OFF to ON.

## Setting items for expansion parameters

The setting items for the "expansion parameters" are shown below. The "expansion parameters" are set for each axis.

| Expansion parameter | | Related sub function |
|---|---|---|
| [Pr.91] | Optional data monitor: Data type setting 1 | ☞ Page 340 Optional Data Monitor Function |
| [Pr.92] | Optional data monitor: Data type setting 2 | |
| [Pr.93] | Optional data monitor: Data type setting 3 | |
| [Pr.94] | Optional data monitor: Data type setting 4 | |

## Setting items for servo parameters

The servo parameters are used to control the servo motor and the data that is determined by the specification of the servo amplifier being used. The setting item is different depending on the servo amplifier being used.

| Servo parameter | | Remark |
|---|---|---|
| PA01 to PA32 | PA group | Setting items are different according to the servo series. |
| PB01 to PB64 | PB group | |
| PC01 to PC64 | PC group | |
| PD01 to PD48 | PD group | |
| PE01 to PE64 | PE group | |
| PS01 to PS32 | PS group | |
| PF01 to PF48 | PF group | |
| Po01 to Po32 | Po group | |
| PL01 to PL48 | PL group | |

# Setting items for positioning data

Positioning data must be set for carrying out any "major positioning control". The table below lists the items to be set for producing the positioning data.

One to 600 positioning data items can be set for each axis.

◎: Always set

○: Set as required ("—" when not required)

×: Setting not possible (If set, the error "Continuous path control not possible" (error code: 1A1EH to 1A20H) will occur at start.)

△: Setting limited

—: Setting not required (The setting value is invalid. When the value is the default value or within the setting range, there is no problem.)

| Positioning data | | | Position control | | | | 1 to 4 axis speed control |
|---|---|---|---|---|---|---|---|
| | | | 1-axis linear control 2/3/4-axis linear interpolation control | 1-axis fixed-feed control, 2/3/4-axis fixed-feed control | 2-axis circular interpolation control | 3-axis helical interpolation control | |
| [Da.1] | Operation pattern | Independent positioning control (Positioning complete) | ◎ | ◎ | ◎ | ◎ | ◎ |
| | | Continuous positioning control | ◎ | ◎ | ◎ | ◎ | × |
| | | Continuous path control | ◎ | × | ◎ | ◎ | × |
| [Da.2] | Control method | | Linear 1<br>Linear 2<br>Linear 3<br>Linear 4<br>*1 | Fixed-feed 1<br>Fixed-feed 2<br>Fixed-feed 3<br>Fixed-feed 4 | Circular sub<br>Circular right<br>Circular left<br>*1 | Helical sub<br>Helical right<br>Helical left<br>*1 | Forward run speed 1<br>Reverse run speed 1<br>Forward run speed 2<br>Reverse run speed 2<br>Forward run speed 3<br>Reverse run speed 3<br>Forward run speed 4<br>Reverse run speed 4 |
| [Da.3] | Acceleration time No. | | ◎ | ◎ | ◎ | ◎ | ◎ |
| [Da.4] | Deceleration time No. | | ◎ | ◎ | ◎ | ◎ | ◎ |
| [Da.6] | Positioning address/ movement amount | | ◎ | ◎ | ◎ | ◎ | — |
| [Da.7] | Arc address | | — | — | ◎ | ◎ | — |
| [Da.8] | Command speed | | ◎ | ◎ | ◎ | ◎ | ◎ |
| [Da.9] | Dwell time/JUMP destination positioning data No. | | ○ | ○ | ○ | ○ | — |
| [Da.10] | M code/Condition data No./ Number of LOOP to LEND repetitions/Number of pitches | | ○ | ○ | ○ | ○*2 | ○ |
| [Da.20] | Axis to be interpolated 1 | | ◎: 2 axes, 3 axes, 4 axes, —: 1 axis | | | | |
| [Da.21] | Axis to be interpolated 2 | | ◎: 3 axes, 4 axes, —: 1 axis, 2 axes | | | | |
| [Da.22] | Axis to be interpolated 3 | | ◎: 4 axes, —: 1 axis, 2 axes, 3 axes | | | | |
| [Da.27] | M code ON signal output timing | | ○ | ○ | ○ | ○ | ○ |
| [Da.28] | ABS direction in degrees | | ○ | ○ | ○ | ○ | ○ |
| [Da.29] | Interpolation speed designation method | | △ | △ | △ | △ | △ |

*1 Two control systems are available: the absolute (ABS) system and incremental (INC) system.

*2 Set an M code for the reference axis and set the number of pitches for the linear interpolation axis.

◎: Always set

○: Set as required ("—" when not required)

×: Setting not possible (If set, the error "Continuous path control not possible" (error code: 1A1EH to 1A20H) will occur at start.)

—: Setting not required (The setting value is invalid. When the value is the default value or within the setting range, there is no problem.)

| Positioning data | | | Speed-position switching control | Position-speed switching control |
|---|---|---|---|---|
| [Da.1] | Operation pattern | Independent positioning control (Positioning complete) | ◎ | ◎ |
| | | Continuous positioning control | ◎ | × |
| | | Continuous path control | × | × |
| [Da.2] | Control method | | Forward run speed/position<br>Reverse run speed/position<br>*1 | Forward run position/speed<br>Reverse run position/speed |
| [Da.3] | Acceleration time No. | | ◎ | ◎ |
| [Da.4] | Deceleration time No. | | ◎ | ◎ |
| [Da.6] | Positioning address/movement amount | | ◎ | ◎ |
| [Da.7] | Arc address | | — | — |
| [Da.8] | Command speed | | ◎ | ◎ |
| [Da.9] | Dwell time/JUMP destination positioning data No. | | ○ | ○ |
| [Da.10] | M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches | | ○ | ○ |
| [Da.20] | Axis to be interpolated 1 | | — | — |
| [Da.21] | Axis to be interpolated 2 | | — | — |
| [Da.22] | Axis to be interpolated 3 | | — | — |
| [Da.27] | M code ON signal output timing | | ○ | ○ |
| [Da.28] | ABS direction in degrees | | ○ | ○ |
| [Da.29] | Interpolation speed designation method | | — | — |

*1 Two control systems are available: the absolute (ABS) system and incremental (INC) system.

◎: Always set

○: Set as required ("—" when not required)

×: Setting not possible (If set, the error "Continuous path control not possible" (error code: 1A1EH to 1A20H) will occur at start.)

—: Setting not required (The setting value is invalid. When the value is the default value or within the setting range, there is no problem.)

| Positioning data | | | Other control | | | | |
|---|---|---|---|---|---|---|---|
| | | | NOP instruction | Current value changing | JUMP instruction | LOOP | LEND |
| [Da.1] | Operation pattern | Independent positioning control (Positioning complete) | — | ◎ | — | — | — |
| | | Continuous positioning control | — | ◎ | — | — | — |
| | | Continuous path control | — | × | — | — | — |
| [Da.2] | Control method | | NOP | Current value changing | JUMP instruction | LOOP | LEND |
| [Da.3] | Acceleration time No. | | — | — | — | — | — |
| [Da.4] | Deceleration time No. | | — | — | — | — | — |
| [Da.6] | Positioning address/movement amount | | — | New address | — | — | — |
| [Da.7] | Arc address | | — | — | — | — | — |
| [Da.8] | Command speed | | — | — | — | — | — |
| [Da.9] | Dwell time/JUMP destination positioning data No. | | — | — | JUMP destination positioning data No. | — | — |
| [Da.10] | M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches | | — | ○ | JUMP condition data No. | Number of LOOP to LEND repetitions | — |
| [Da.20] | Axis to be interpolated 1 | | — | — | — | — | — |
| [Da.21] | Axis to be interpolated 2 | | — | — | — | — | — |
| [Da.22] | Axis to be interpolated 3 | | — | — | — | — | — |
| [Da.27] | M code ON signal output timing | | — | ○ | — | — | — |
| [Da.28] | ABS direction in degrees | | ○ | ○ | ○ | ○ | ○ |
| [Da.29] | Interpolation speed designation method | | — | — | — | — | — |

## Checking the positioning data

[Da.1] to [Da.10], [Da.20] to [Da.22], [Da.27] to [Da.29] are checked at the following timings:

- Startup of a positioning operation

# Setting items for block start data

The "block start data" must be set when carrying out "high-level positioning control". The setting items for the "block start data" are shown below.

Up to 50 points of "block start data" can be set for each axis.

○: Set as required ("—" when not required)

—: Setting not required (The setting value is invalid. When the value is the default value or within the setting range, there is no problem.)

| Block start data | | Block start (Normal start) | Condition start | Wait start | Simultaneous start | Repeated start (FOR loop) | Repeated start (FOR condition) |
|---|---|---|---|---|---|---|---|
| [Da.11] | Shape (end/continue) | ○ | ○ | ○ | ○ | ○ | ○ |
| [Da.12] | Start data No. | ○ | ○ | ○ | ○ | ○ | ○ |
| [Da.13] | Special start instruction | — | ○ | ○ | ○ | ○ | ○ |
| [Da.14] | Parameter | — | ○ | ○ | ○ | ○ | ○ |

## Checking the block start data

[Da.11] to [Da.14] are checked with the following timing.

- When "Block start data" starts

# Setting items for condition data

When carrying out "high-level positioning control" or using the JUMP instruction in the "major positioning control", the "condition data" must be set as required. The setting items for the "condition data" are shown below.

Up to 10 "condition data" items can be set for each axis.

○: Set as required ("—" when not required)

△: Setting limited

—: Setting not required (The setting value is invalid. When the value is the default value or within the setting range, there is no problem.)

| Condition data | | Major positioning control | | High-level positioning control | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Other than JUMP instruction | JUMP instruction | Block start (Normal start) | Condition start | Wait start | Simultaneous start | Repeated start (FOR loop) | Repeated start (FOR condition) |
| [Da.15] | Condition target | — | ○ | — | ○ | ○ | ○ | — | ○ |
| [Da.16] | Condition operator | — | ○ | — | ○ | ○ | ○ | — | ○ |
| [Da.17] | Address | — | △ | — | △ | △ | — | — | △ |
| [Da.18] | Parameter 1 | — | ○ | — | ○ | ○ | △ | — | ○ |
| [Da.19] | Parameter 2 | — | △ | — | △ | △ | △ | — | △ |
| [Da.23] | Number of simultaneously starting axes | — | — | — | — | — | ○ | — | — |
| [Da.24] | Simultaneously starting axis No.1 | — | — | — | — | — | ○ | — | — |
| [Da.25] | Simultaneously starting axis No.2 | — | — | — | — | — | ○ | — | — |
| [Da.26] | Simultaneously starting axis No.3 | — | — | — | — | — | ○ | — | — |

## Checking the condition data

[Da.15] to [Da.19], [Da.23] to [Da.26] are checked with the following timing.

- When "Block start data" starts
- When "JUMP instruction" starts

# Types and roles of monitor data

The monitor data area in the buffer memory stores data relating to the operating state of the positioning system, which are monitored as required while the positioning system is operating.

The following data are available for monitoring.

| Item | Description |
|---|---|
| System monitoring | Monitoring of the specification and operation history of Simple Motion module (system monitor data [Md.3] to [Md.8], [Md.19], [Md.50] to [Md.54], [Md.59], [Md.60], [Md.130] to [Md.135], servo network composition status [Md.105]) |
| Axis operation monitoring | Monitoring of the current position and speed, and other data related to the movements of axes (axis monitor data [Md.20] to [Md.48], [Md.62], [Md.100] to [Md.116], [Md.119] to [Md.125], [Md.500], [Md.502], [Md.503]) |

## Monitoring the system

### ■Monitoring the positioning system operation history

| Monitoring details | | | Corresponding item |
|---|---|---|---|
| History of data that started an operation | Start information | | [Md.3] Start information |
| | Start No. | | [Md.4] Start No. |
| | Start[*1] | Year: month | [Md.54] Start (Year: month) |
| | | Day: hour | [Md.5] Start (Day: hour) |
| | | Minute: second | [Md.6] Start (Minute: second) |
| | | ms | [Md.60] Start (ms) |
| | Error upon starting | | [Md.7] Error judgment |
| | Pointer No. next to the pointer No. where the latest history is stored | | [Md.8] Start history pointer |
| Number of write accesses to the flash ROM after the power is switched ON | Number of write accesses to flash ROM | | [Md.19] Number of write accesses to flash ROM |
| Forced stop input signal (EMI) turn ON/OFF | Forced stop input signal (EMI) information | | [Md.50] Forced stop input |
| Monitor whether the system is in amplifier-less operation | | | [Md.51] Amplifier-less operation mode status |
| Monitor the detection status of axis that set communication between amplifiers | | | [Md.52] Communication between amplifiers axes searching flag |
| Monitor the connect/disconnect status of SSCNET communication | | | [Md.53] SSCNET control status |
| Store the module information | | | [Md.59] Module information |
| Monitor the first five digits of product information | | | [Md.130] F/W version |
| Monitor the RUN status of digital oscilloscope | | | [Md.131] Digital oscilloscope running flag |
| Monitor the current operation cycle. | | | [Md.132] Operation cycle setting |
| Monitor whether the operation cycle time exceeds operation cycle. | | | [Md.133] Operation cycle over flag |
| Monitor the time that took for operation every operation cycle. | | | [Md.134] Operation time |
| Monitor the maximum value of operation time after each module's power supply ON. | | | [Md.135] Maximum operation time |

*1 Displays a value set by the clock function of the CPU module.

## Monitoring the axis operation state

### ■Monitoring the position

| Monitor details | Corresponding item |
|---|---|
| Monitor the current machine feed value | [Md.21] Machine feed value |
| Monitor the current feed value | [Md.20] Current feed value |
| Monitor the current target value | [Md.32] Target value |

## ■Monitoring the speed

| Monitor details | | | | Corresponding item |
|---|---|---|---|---|
| Monitor the current speed | During independent axis control | | Indicates the speed of each axis | [Md.22] Feedrate |
| | During interpolation control | When "0: Composite speed" is set for "[Pr.20] Interpolation speed designation method" | Indicates the composite speed | |
| | | When "1: Reference axis speed" is set for "[Pr.20] Interpolation speed designation method" | Indicates the reference axis speed | |
| | Monitor "[Da.8] Command speed" currently being executed. | | | [Md.27] Current speed |
| | Constantly indicates the speed of each axis | | | [Md.28] Axis feedrate |
| Monitor the current target speed | | | | [Md.33] Target speed |
| Monitor the command speed at speed control mode or continuous operation to torque control mode in the speed-torque control | | | | [Md.122] Speed during command |

## ■Monitoring the status of servo amplifier

| Monitor details | Corresponding item |
|---|---|
| Monitor the real current value "feed current value - (command pulse - feedback pulse)". | [Md.101] Real current value |
| Monitor the pulse droop. | [Md.102] Deviation counter value |
| Monitor the motor speed of servo motor. | [Md.103] Motor rotation speed |
| Monitor the current value of servo motor. | [Md.104] Motor current value |
| Monitor the servo amplifier type of each axis. | [Md.105] Connected device |
| Monitor the software No. of servo amplifier. | [Md.106] Servo amplifier software No. |
| Monitor the parameter No. that an error occurred. | [Md.107] Parameter error No. |
| Monitor the status (servo status) of servo amplifier. | [Md.108] Servo status1 |
| | [Md.119] Servo status2 |
| | [Md.125] Servo status3 |
| | [Md.500] Servo status7 |
| • Monitor the percentage of regenerative power to permissible regenerative value.<br>• Monitor the content of "[Pr.91] Optional data monitor: Data type setting 1" at optional data monitor data type setting. | [Md.109] Regenerative load ratio/Optional data monitor output 1 |
| • Monitor the continuous effective load torque.<br>• Monitor the content of "[Pr.92] Optional data monitor: Data type setting 2" at optional data monitor data type setting. | [Md.110] Effective load torque/Optional data monitor output 2 |
| • Monitor the maximum generated torque.<br>• Monitor the content of "[Pr.93] Optional data monitor: Data type setting 3" at optional data monitor data type setting. | [Md.111] Peak torque ratio/Optional data monitor output 3 |
| Monitor the content of "[Pr.94] Optional data monitor: Data type setting 4" at optional data monitor data type setting. | [Md.112] Optional data monitor output 4 |
| Monitor the status of semi closed loop control/fully closed loop control. | [Md.113] Semi/Fully closed loop status |
| Monitor the alarm of servo amplifier. | [Md.114] Servo alarm |
| Monitor the option information of encoder. | [Md.116] Encoder option information |
| Monitor the driver operation alarm number. | [Md.502] Driver operation alarm number |

## ■Monitoring the state

| Monitor details | Corresponding item |
|---|---|
| Monitor the latest error code that occurred with the axis | [Md.23] Axis error No. |
| Monitor the latest warning code that occurred with the axis | [Md.24] Axis warning No. |
| Monitor the valid M codes | [Md.25] Valid M code |
| Monitor the axis operation state | [Md.26] Axis operation status |
| Monitor the movement amount after the current position control switching when using "speed-position switching control". | [Md.29] Speed-position switching control positioning movement amount |
| Monitor the external input/output signal and flag | [Md.30] External input signal |
| | [Md.31] Status |
| Monitor the movement amount from near-point dog ON to machine home position return completion. | [Md.34] Movement amount after near-point dog ON |
| Monitor the current torque limit value | [Md.35] Torque limit stored value/forward torque limit stored value |
| | [Md.120] Reverse torque limit stored value |
| Monitor the "instruction code" of the special start data when using special start | [Md.36] Special start data instruction code setting value |
| Monitor the "instruction parameter" of the special start data when using special start | [Md.37] Special start data instruction parameter setting value |
| Monitor the "start data No." of the special start data when using special start | [Md.38] Start positioning data No. setting value |
| Monitor whether the speed is being limited | [Md.39] In speed limit flag |
| Monitor whether the speed is being changed | [Md.40] In speed change processing flag |
| Monitor the remaining number of repetitions (special start) | [Md.41] Special start repetition counter |
| Monitor the remaining number of repetitions (control system) | [Md.42] Control system repetition counter |
| Monitor the "start data" point currently being executed | [Md.43] Start data pointer being executed |
| Monitor the "positioning data No." currently being executed | [Md.44] Positioning data No. being executed |
| Monitor the block No. | [Md.45] Block No. being executed |
| Monitor the "positioning data No." executed last | [Md.46] Last executed positioning data No. |
| Monitor the positioning data currently being executed | [Md.47] Positioning data being executed |
| Monitor switching from the constant speed status or acceleration status to the deceleration status during position control whose operation pattern is "Positioning complete" | [Md.48] Deceleration start flag |
| Monitor the carrying over movement amount which exceeds "[Pr.123] Manual pulse generator speed limit value". | [Md.62] Amount of the manual pulser driving carrying over movement |
| Monitor the distance that travels to zero point after stop once at home position return. | [Md.100] Home position return re-travel value |
| Monitor the command torque at torque control mode or continuous operation to torque control mode in the speed-torque control. | [Md.123] Torque during command |
| Monitor the switching status of control mode. | [Md.124] Control mode switching status |
| Monitor the positioning data analysis status. | [Md.503] Pre-reading data analysis status |

# Types and roles of control data

Operation of the positioning system is achieved through the execution of necessary controls. (Data required for controls are given through the default values when the power is switched ON, which can be modified as required by the program.)
Items that can be controlled are described below.

| | |
|---|---|
| Controlling the system data | Setting and resetting "setting data" of Simple Motion module<br>(system control data [Cd.1], [Cd.2]) |
| Controlling the operation | Setting operation parameters, changing speed during operation, interrupting or restarting operation, etc.<br>(system control data [Cd.41], [Cd.42], [Cd.44], [Cd.102], [Cd.137], axis control data [Cd.3] to [Cd.40], [Cd.43], [Cd.45], [Cd.46], [Cd.100], [Cd.101], [Cd.108], [Cd.112], [Cd.113], [Cd.130] to [Cd.133], [Cd.136] to [Cd.154], [Cd.180] to [Cd.183]) |



## Controlling the system data

### ■Setting and resetting the setting data

| Control details | Controlled data item |
|---|---|
| Write setting data from buffer memory to flash ROM. | [Cd.1] Flash ROM write request |
| Reset (initialize) parameters. | [Cd.2] Parameter initialization request |

## Controlling the operation

### ■Controlling the operation

| Control details | Corresponding item |
|---|---|
| Set which positioning to execute (start No.). | [Cd.3] Positioning start No. |
| Set start point No. for executing block start. | [Cd.4] Positioning starting point No. |
| Clear (reset) the axis error ([Md.23]) and warning ([Md.24]). | [Cd.5] Axis error reset |
| Issue instruction to restart (When axis operation is stopped). | [Cd.6] Restart command |
| Stop continuous control. | [Cd.18] Interrupt request during continuous operation |
| Set start data No. of own axis at multiple axes simultaneous starting. | [Cd.30] Simultaneous starting own axis start data No. |
| Set start data No.1 for axes that start up simultaneously. | [Cd.31] Simultaneous starting axis start data No.1 |
| Set start data No.2 for axes that start up simultaneously. | [Cd.32] Simultaneous starting axis start data No.2 |
| Set start data No.3 for axes that start up simultaneously. | [Cd.33] Simultaneous starting axis start data No.3 |
| Stop (deceleration stop) the current positioning operation and execute the next positioning operation. | [Cd.37] Skip command |
| Specify write destination for teaching results. | [Cd.38] Teaching data selection |
| Specify data to be taught. | [Cd.39] Teaching positioning data No. |
| Set number of simultaneous starting axes and target axis. | [Cd.43] Simultaneous starting axis |
| Set the status of the external input signal (upper/lower limit switch signal, near-point dog signal, stop signal). | [Cd.44] External input signal operation device (Axis 1 to 16) |
| Stop axis in control. | [Cd.180] Axis stop |
| Execute start request of JOG operation or inching operation. | [Cd.181] Forward run JOG start |
| | [Cd.182] Reverse run JOG start |
| Execute pre-reading at positioning start. | [Cd.183] Execution prohibition flag |

### ■Controlling operation per step

| Control details | Corresponding item |
|---|---|
| Set unit to carry out step. | [Cd.34] Step mode |
| Stop positioning operation after each operation. | [Cd.35] Step valid flag |
| Continuous operation from stopped step. | [Cd.36] Step start information |

## ■Controlling the speed

| Control details | Corresponding item |
|---|---|
| When changing acceleration time during speed change, set new acceleration time. | [Cd.10] New acceleration time value |
| When changing deceleration time during speed change, set new deceleration time. | [Cd.11] New deceleration time value |
| Set acceleration/deceleration time validity during speed change. | [Cd.12] Acceleration/deceleration time change value during speed change, enable/disable |
| Change positioning operation speed between 0 and 300% range. | [Cd.13] Positioning operation speed override |
| Set new speed when changing speed during operation. | [Cd.14] New speed value |
| Issue instruction to change speed in operation to [Cd.14] value. (Only during positioning operation and JOG operation). | [Cd.15] Speed change request |
| Set inching movement amount. | [Cd.16] Inching movement amount |
| Set JOG speed. | [Cd.17] JOG speed |

## ■Change operation mode

| Control details | Corresponding item |
|---|---|
| Change operation mode. | [Cd.137] Amplifier-less operation mode switching request |

## ■Making settings related to operation

| Control details | Corresponding item |
|---|---|
| Turn M code ON signal OFF. | [Cd.7] M code OFF request |
| Validate external command signal. | [Cd.8] External command valid |
| Set new value when changing current value. | [Cd.9] New current value |
| Change home position return request flag from "ON to OFF". | [Cd.19] Home position return request flag OFF request |
| Set scale per pulse of number of input pulses from manual pulse generator. | [Cd.20] Manual pulse generator 1 pulse input magnification |
| Set manual pulse generator operation validity. | [Cd.21] Manual pulse generator enable flag |
| Change "[Md.35] Torque limit stored value/forward torque limit stored value". | [Cd.22] New torque value/forward new torque value |
| Change movement amount for position control during speed-position switching control (INC mode). | [Cd.23] Speed-position switching control movement amount change register |
| Validate switching signal set in "[Cd.45] Speed-position switching device selection". | [Cd.24] Speed-position switching enable flag |
| Change speed for speed control during position-speed switching control. | [Cd.25] Position-speed switching control speed change register |
| Validate switching signal set in "[Cd.45] Speed-position switching device selection". | [Cd.26] Position-speed switching enable flag |
| Set new positioning address when changing target position during positioning. | [Cd.27] Target position change value (New address) |
| Set new speed when changing target position during positioning. | [Cd.28] Target position change value (New speed) |
| Set up a flag when target position is changed during positioning. | [Cd.29] Target position change request flag |
| Set absolute (ABS) moving direction in degrees. | [Cd.40] ABS direction in degrees |
| Set whether "[Md.48] Deceleration start flag" is valid or invalid | [Cd.41] Deceleration start flag valid |
| Set the stop command processing for deceleration stop function (deceleration curve re-processing/ deceleration curve continuation) | [Cd.42] Stop command processing for deceleration stop selection |
| Set the device used for speed-position switching. | [Cd.45] Speed-position switching device selection |
| Switch speed-position control. | [Cd.46] Speed-position switching command |
| Turn the servo OFF for each axis. | [Cd.100] Servo OFF command |
| Set torque limit value | [Cd.101] Torque output setting value |
| Set the connect/disconnect of SSCNET communication. | [Cd.102] SSCNET control command |
| Set whether gain changing is execution or not. | [Cd.108] Gain changing command flag |
| Set "same setting/individual setting" of the forward torque limit value or reverse torque limit value in the torque change function. | [Cd.112] Torque change function switching request |
| Change "[Md.120] Reverse torque limit stored value". | [Cd.113] Reverse new torque value |
| Set the semi closed loop control/fully closed loop control. | [Cd.133] Semi/Fully closed loop switching request |

| Control details | | Corresponding item |
|---|---|---|
| Set the PI-PID switching to servo amplifier. | | [Cd.136] PI-PID switching request |
| Speed-torque control | Switch the control mode. | [Cd.138] Control mode switching request |
| | Set the control mode to switch. | [Cd.139] Control mode setting |
| | Set the command speed during speed control mode. | [Cd.140] Command speed at speed control mode |
| | Set the acceleration time during speed control mode. | [Cd.141] Acceleration time at speed control mode |
| | Set the deceleration time during speed control mode. | [Cd.142] Deceleration time at speed control mode |
| | Set the command torque during torque control mode. | [Cd.143] Command torque at torque control mode |
| | Set the time constant at driving of torque control mode. | [Cd.144] Torque time constant at torque control mode (Forward direction) |
| | Set the time constant at regeneration of torque control mode. | [Cd.145] Torque time constant at torque control mode (Negative direction) |
| | Set the speed limit value during torque control mode. | [Cd.146] Speed limit value at torque control mode |
| | Set the command speed during continuous operation to torque control mode. | [Cd.147] Speed limit value at continuous operation to torque control mode |
| | Set the acceleration time during continuous operation to torque control mode. | [Cd.148] Acceleration time at continuous operation to torque control mode |
| | Set the deceleration time during continuous operation to torque control mode. | [Cd.149] Deceleration time at continuous operation to torque control mode |
| | Set the target torque during continuous operation to torque control mode. | [Cd.150] Target torque at continuous operation to torque control mode |
| | Set the time constant at driving of continuous operation to torque control mode. | [Cd.151] Torque time constant at continuous operation to torque control mode (Forward direction) |
| | Set the time constant at regeneration of continuous operation to torque control mode. | [Cd.152] Torque time constant at continuous operation to torque control mode (Negative direction) |
| | Set the switching conditions for switching to continuous operation to torque control mode. | [Cd.153] Control mode auto-shift selection |
| | Set the condition value when "[Cd.153] Control mode auto-shift selection" is set. | [Cd.154] Control mode auto-shift parameter |

# 12.2 List of Buffer Memory Addresses

The following shows the relation between the buffer memory addresses and the various items.

Do not use the buffer memory address that not been described here for a "Maker setting".

For the list of buffer memory addresses for positioning data, refer to the "Simple Motion Module Setting Function Help" of the engineering tool.

Refer to the following for the list of buffer memory addresses for synchronous control.

MELSEC iQ-R Simple Motion Module User's Manual (Advanced Synchronous Control)

## Basic setting

n: Axis No. - 1

| Memory area | | Item | | Buffer memory address |
|---|---|---|---|---|
| Common parameters | | [Pr.24] | Manual pulse generator/Incremental synchronous encoder input selection | 33 |
| | | [Pr.82] | Forced stop valid/invalid selection | 35 |
| | | [Pr.89] | Manual pulse generator/Incremental synchronous encoder input type selection | 67 |
| | | [Pr.96] | Operation cycle setting | 105 |
| | | [Pr.97] | SSCNET setting | 106 |
| | | [Pr.150] | Input terminal logic selection | 58000<br>58001 |
| | | [Pr.151] | Manual pulse generator/Incremental synchronous encoder input logic selection | 58002 |
| | | [Pr.152] | Maximum number of control axes | 58003 |
| | | [Pr.153] | External input signal digital filter setting 1 (SIN1 to 4)<br>External input signal digital filter setting 2 (SIN5 to 8)<br>External input signal digital filter setting 3 (SIN9 to 12)<br>External input signal digital filter setting 4 (SIN13 to 16)<br>External input signal digital filter setting 5 (SIN17 to 20) | 58004<br>58005<br>58006<br>58007<br>58008 |
| Positioning parameters | Basic parameters 1 | [Pr.1] | Unit setting | 0+150n |
| | | [Pr.2] | Number of pulses per rotation (AP) | 2+150n<br>3+150n |
| | | [Pr.3] | Movement amount per rotation (AL) | 4+150n<br>5+150n |
| | | [Pr.4] | Unit magnification (AM) | 1+150n |
| | | [Pr.7] | Bias speed at start | 6+150n<br>7+150n |
| | Basic parameters 2 | [Pr.8] | Speed limit value | 10+150n<br>11+150n |
| | | [Pr.9] | Acceleration time 0 | 12+150n<br>13+150n |
| | | [Pr.10] | Deceleration time 0 | 14+150n<br>15+150n |
| | Detailed parameters 1 | [Pr.11] | Backlash compensation amount | 17+150n |
| | | [Pr.12] | Software stroke limit upper limit value | 18+150n<br>19+150n |
| | | [Pr.13] | Software stroke limit lower limit value | 20+150n<br>21+150n |
| | | [Pr.14] | Software stroke limit selection | 22+150n |
| | | [Pr.15] | Software stroke limit valid/invalid setting | 23+150n |
| | | [Pr.16] | Command in-position width | 24+150n<br>25+150n |
| | | [Pr.17] | Torque limit setting value | 26+150n |
| | | [Pr.18] | M code ON signal output timing | 27+150n |
| | | [Pr.19] | Speed switching mode | 28+150n |
| | | [Pr.20] | Interpolation speed designation method | 29+150n |
| | | [Pr.21] | Current feed value during speed control | 30+150n |

| Memory area | | Item | | Buffer memory address |
|---|---|---|---|---|
| Positioning parameters | Detailed parameters 1 | [Pr.22] | Input signal logic selection | 31+150n |
| | | [Pr.81] | Speed-position function selection | 34+150n |
| | | [Pr.116] | FLS signal selection | 116+150n |
| | | [Pr.117] | RLS signal selection | 117+150n |
| | | [Pr.118] | DOG signal selection | 118+150n |
| | | [Pr.119] | STOP signal selection | 119+150n |
| | Detailed parameters 2 | [Pr.25] | Acceleration time 1 | 36+150n<br>37+150n |
| | | [Pr.26] | Acceleration time 2 | 38+150n<br>39+150n |
| | | [Pr.27] | Acceleration time 3 | 40+150n<br>41+150n |
| | | [Pr.28] | Deceleration time 1 | 42+150n<br>43+150n |
| | | [Pr.29] | Deceleration time 2 | 44+150n<br>45+150n |
| | | [Pr.30] | Deceleration time 3 | 46+150n<br>47+150n |
| | | [Pr.31] | JOG speed limit value | 48+150n<br>49+150n |
| | | [Pr.32] | JOG operation acceleration time selection | 50+150n |
| | | [Pr.33] | JOG operation deceleration time selection | 51+150n |
| | | [Pr.34] | Acceleration/deceleration process selection | 52+150n |
| | | [Pr.35] | S-curve ratio | 53+150n |
| | | [Pr.36] | Sudden stop deceleration time | 54+150n<br>55+150n |
| | | [Pr.37] | Stop group 1 sudden stop selection | 56+150n |
| | | [Pr.38] | Stop group 2 sudden stop selection | 57+150n |
| | | [Pr.39] | Stop group 3 sudden stop selection | 58+150n |
| | | [Pr.40] | Positioning complete signal output time | 59+150n |
| | | [Pr.41] | Allowable circular interpolation error width | 60+150n<br>61+150n |
| | | [Pr.42] | External command function selection | 62+150n |
| | | [Pr.83] | Speed control 10 × multiplier setting for degree axis | 63+150n |
| | | [Pr.84] | Restart allowable range when servo OFF to ON | 64+150n<br>65+150n |
| | | [Pr.90] | Operation setting for speed-torque control mode | 68+150n |
| | | [Pr.95] | External command signal selection | 69+150n |
| | | [Pr.122] | Manual pulse generator speed limit mode | 121+150n |
| | | [Pr.123] | Manual pulse generator speed limit value | 122+150n<br>123+150n |
| Home position return parameters | Home position return basic parameters | [Pr.43] | Home position return method | 70+150n |
| | | [Pr.44] | Home position return direction | 71+150n |
| | | [Pr.45] | Home position address | 72+150n<br>73+150n |
| | | [Pr.46] | Home position return speed | 74+150n<br>75+150n |
| | | [Pr.47] | Creep speed | 76+150n<br>77+150n |
| | | [Pr.48] | Home position return retry | 78+150n |

| Memory area | | Item | | Buffer memory address |
|---|---|---|---|---|
| Home position return parameters | Home position return detailed parameters | [Pr.50] | Setting for the movement amount after near-point dog ON | 80+150n<br>81+150n |
| | | [Pr.51] | Home position return acceleration time selection | 82+150n |
| | | [Pr.52] | Home position return deceleration time selection | 83+150n |
| | | [Pr.53] | Home position shift amount | 84+150n<br>85+150n |
| | | [Pr.54] | Home position return torque limit value | 86+150n |
| | | [Pr.55] | Operation setting for incompletion of home position return | 87+150n |
| | | [Pr.56] | Speed designation during home position shift | 88+150n |
| | | [Pr.57] | Dwell time during home position return retry | 89+150n |
| Expansion parameter | | [Pr.91] | Optional data monitor: Data type setting 1 | 100+150n |
| | | [Pr.92] | Optional data monitor: Data type setting 2 | 101+150n |
| | | [Pr.93] | Optional data monitor: Data type setting 3 | 102+150n |
| | | [Pr.94] | Optional data monitor: Data type setting 4 | 103+150n |

## Monitor data

n: Axis No. - 1

p: Pointer No. - 1

| Memory area | Item | | | Buffer memory address |
|---|---|---|---|---|
| System monitor data | [Md.3] | Start information | Start history[*1] | 87010+10p |
| | [Md.4] | Start No. | | 87011+10p |
| | [Md.54] | Start (Year: month) | | 87012+10p |
| | [Md.5] | Start (Day: hour) | | 87013+10p |
| | [Md.6] | Start (Minute: second) | | 87014+10p |
| | [Md.60] | Start (ms) | | 87015+10p |
| | [Md.7] | Error judgment | | 87016+10p |
| | [Md.8] | Start history pointer | | 87000 |
| | [Md.19] | Number of write accesses to flash ROM | | 4224<br>4225 |
| | [Md.50] | Forced stop input | | 4231 |
| | [Md.51] | Amplifier-less operation mode status | | 4232 |
| | [Md.52] | Communication between amplifiers axes searching flag | | 4234 |
| | [Md.53] | SSCNET control status | | 4233 |
| | [Md.59] | Module information | | 31332 |
| | [Md.130] | F/W version | | 4006<br>4007 |
| | [Md.131] | Digital oscilloscope running flag | | 4011 |
| | [Md.132] | Operation cycle setting | | 4238 |
| | [Md.133] | Operation cycle over flag | | 4239 |
| | [Md.134] | Operation time | | 4008 |
| | [Md.135] | Maximum operation time | | 4009 |
| Axis monitor data | [Md.20] | Current feed value | | 2400+100n<br>2401+100n |
| | [Md.21] | Machine feed value | | 2402+100n<br>2403+100n |
| | [Md.22] | Feedrate | | 2404+100n<br>2405+100n |
| | [Md.23] | Axis error No. | | 2406+100n |
| | [Md.24] | Axis warning No. | | 2407+100n |
| | [Md.25] | Valid M code | | 2408+100n |
| | [Md.26] | Axis operation status | | 2409+100n |
| | [Md.27] | Current speed | | 2410+100n<br>2411+100n |
| | [Md.28] | Axis feedrate | | 2412+100n<br>2413+100n |

| Memory area | Item | | | Buffer memory address |
|---|---|---|---|---|
| Axis monitor data | [Md.29] | Speed-position switching control positioning movement amount | | 2414+100n<br>2415+100n |
| | [Md.30] | External input signal | | 2416+100n |
| | [Md.31] | Status | | 2417+100n |
| | [Md.32] | Target value | | 2418+100n<br>2419+100n |
| | [Md.33] | Target speed | | 2420+100n<br>2421+100n |
| | [Md.34] | Movement amount after near-point dog ON | | 2424+100n<br>2425+100n |
| | [Md.35] | Torque limit stored value/forward torque limit stored value | | 2426+100n |
| | [Md.36] | Special start data instruction code setting value | | 2427+100n |
| | [Md.37] | Special start data instruction parameter setting value | | 2428+100n |
| | [Md.38] | Start positioning data No. setting value. | | 2429+100n |
| | [Md.39] | In speed limit flag | | 2430+100n |
| | [Md.40] | In speed change processing flag | | 2431+100n |
| | [Md.41] | Special start repetition counter | | 2432+100n |
| | [Md.42] | Control system repetition counter | | 2433+100n |
| | [Md.43] | Start data pointer being executed | | 2434+100n |
| | [Md.44] | Positioning data No. being executed | | 2435+100n |
| | [Md.45] | Block No. being executed | | 2436+100n |
| | [Md.46] | Last executed positioning data No. | | 2437+100n |
| | [Md.47] | Positioning data being executed | Positioning identifier | 2438+100n |
| | | | M code | 2439+100n |
| | | | Dwell time | 2440+100n |
| | | | Positioning option | 2441+100n |
| | | | Command speed | 2442+100n<br>2443+100n |
| | | | Positioning address | 2444+100n<br>2445+100n |
| | | | Arc address | 2446+100n<br>2447+100n |
| | | | Axis to be interpolated | 2496+100n<br>2497+100n |
| | [Md.48] | Deceleration start flag | | 2499+100n |
| | [Md.62] | Amount of the manual pulser driving carrying over movement | | 2422+100n<br>2423+100n |
| | [Md.100] | Home position return re-travel value | | 2448+100n<br>2449+100n |
| | [Md.101] | Real current value | | 2450+100n<br>2451+100n |
| | [Md.102] | Deviation counter value | | 2452+100n<br>2453+100n |
| | [Md.103] | Motor rotation speed | | 2454+100n<br>2455+100n |
| | [Md.104] | Motor current value | | 2456+100n |
| | [Md.106] | Servo amplifier software No. | | 2464+100n<br>2465+100n<br>2466+100n<br>2467+100n<br>2468+100n<br>2469+100n |
| | [Md.107] | Parameter error No. | | 2470+100n |
| | [Md.108] | Servo status1 | | 2477+100n |
| | [Md.109] | Regenerative load ratio/Optional data monitor output 1 | | 2478+100n |
| | [Md.110] | Effective load torque/Optional data monitor output 2 | | 2479+100n |
| | [Md.111] | Peak torque ratio/Optional data monitor output 3 | | 2480+100n |

| Memory area | Item | | Buffer memory address |
|---|---|---|---|
| Axis monitor data | [Md.112] | Optional data monitor output 4 | 2481+100n |
| | [Md.113] | Semi/Fully closed loop status | 2487+100n |
| | [Md.114] | Servo alarm | 2488+100n |
| | [Md.116] | Encoder option information | 2490+100n |
| | [Md.119] | Servo status2 | 2476+100n |
| | [Md.120] | Reverse torque limit stored value | 2491+100n |
| | [Md.122] | Speed during command | 2492+100n<br>2493+100n |
| | [Md.123] | Torque during command | 2494+100n |
| | [Md.124] | Control mode switching status | 2495+100n |
| | [Md.125] | Servo status3 | 2458+100n |
| | [Md.500] | Servo status7 | 59300+100n |
| | [Md.502] | Driver operation alarm number | 59302+100n |
| | [Md.503] | Pre-reading data analysis status | 59303+100n |
| Servo network composition status | [Md.105] | Connected device | 58660<br>58661 |

*1 Displays a value set by the clock function of the CPU module.

## Control data

n: Axis No. - 1

| Memory area | Item | | Buffer memory address |
|---|---|---|---|
| Axis control data | [Cd.3] | Positioning start No. | 4300+100n |
| | [Cd.4] | Positioning starting point No. | 4301+100n |
| | [Cd.5] | Axis error reset | 4302+100n |
| | [Cd.6] | Restart command | 4303+100n |
| | [Cd.7] | M code OFF request | 4304+100n |
| | [Cd.8] | External command valid | 4305+100n |
| | [Cd.9] | New current value | 4306+100n<br>4307+100n |
| | [Cd.10] | New acceleration time value | 4308+100n<br>4309+100n |
| | [Cd.11] | New deceleration time value | 4310+100n<br>4311+100n |
| | [Cd.12] | Acceleration/deceleration time change value during speed change, enable/disable | 4312+100n |
| | [Cd.13] | Positioning operation speed override | 4313+100n |
| | [Cd.14] | New speed value | 4314+100n<br>4315+100n |
| | [Cd.15] | Speed change request | 4316+100n |
| | [Cd.16] | Inching movement amount | 4317+100n |

| Memory area | Item | | Buffer memory address |
|---|---|---|---|
| Axis control data | [Cd.17] | JOG speed | 4318+100n<br>4319+100n |
| | [Cd.18] | Interrupt request during continuous operation | 4320+100n |
| | [Cd.19] | Home position return request flag OFF request | 4321+100n |
| | [Cd.20] | Manual pulse generator 1 pulse input magnification | 4322+100n<br>4323+100n |
| | [Cd.21] | Manual pulse generator enable flag | 4324+100n |
| | [Cd.22] | New torque value/forward new torque value | 4325+100n |
| | [Cd.23] | Speed-position switching control movement amount change register | 4326+100n<br>4327+100n |
| | [Cd.24] | Speed-position switching enable flag | 4328+100n |
| | [Cd.25] | Position-speed switching control speed change register | 4330+100n<br>4331+100n |
| | [Cd.26] | Position-speed switching enable flag | 4332+100n |
| | [Cd.27] | Target position change value (New address) | 4334+100n<br>4335+100n |
| | [Cd.28] | Target position change value (New speed) | 4336+100n<br>4337+100n |
| | [Cd.29] | Target position change request flag | 4338+100n |
| | [Cd.30] | Simultaneous starting own axis start data No. | 4340+100n |
| | [Cd.31] | Simultaneous starting axis start data No.1 | 4341+100n |
| | [Cd.32] | Simultaneous starting axis start data No.2 | 4342+100n |
| | [Cd.33] | Simultaneous starting axis start data No.3 | 4343+100n |
| | [Cd.34] | Step mode | 4344+100n |
| | [Cd.35] | Step valid flag | 4345+100n |
| | [Cd.36] | Step start information | 4346+100n |
| | [Cd.37] | Skip command | 4347+100n |
| | [Cd.38] | Teaching data selection | 4348+100n |
| | [Cd.39] | Teaching positioning data No. | 4349+100n |
| | [Cd.40] | ABS direction in degrees | 4350+100n |
| | [Cd.43] | Simultaneous starting axis | 4368+100n<br>4369+100n |
| | [Cd.45] | Speed-position switching device selection | 4366+100n |
| | [Cd.46] | Speed-position switching command | 4367+100n |
| | [Cd.100] | Servo OFF command | 4351+100n |
| | [Cd.101] | Torque output setting value | 4352+100n |
| | [Cd.108] | Gain changing command flag | 4359+100n |
| | [Cd.112] | Torque change function switching request | 4363+100n |
| | [Cd.113] | Reverse new torque value | 4364+100n |
| | [Cd.130] | Servo parameter write request | 4354+100n |
| | [Cd.131] | Parameter No. (Setting for servo parameters to be changed) | 4355+100n |
| | [Cd.132] | Change data | 4356+100n<br>4357+100n |
| | [Cd.133] | Semi/Fully closed loop switching request | 4358+100n |
| | [Cd.136] | PI-PID switching request | 4365+100n |
| | [Cd.138] | Control mode switching request | 4374+100n |
| | [Cd.139] | Control mode setting | 4375+100n |
| | [Cd.140] | Command speed at speed control mode | 4376+100n<br>4377+100n |
| | [Cd.141] | Acceleration time at speed control mode | 4378+100n |
| | [Cd.142] | Deceleration time at speed control mode | 4379+100n |
| | [Cd.143] | Command torque at torque control mode | 4380+100n |
| | [Cd.144] | Torque time constant at torque control mode (Forward direction) | 4381+100n |
| | [Cd.145] | Torque time constant at torque control mode (Negative direction) | 4382+100n |

| Memory area | Item | | Buffer memory address |
|---|---|---|---|
| Axis control data | [Cd.146] | Speed limit value at torque control mode | 4384+100n<br>4385+100n |
| | [Cd.147] | Speed limit value at continuous operation to torque control mode | 4386+100n<br>4387+100n |
| | [Cd.148] | Acceleration time at continuous operation to torque control mode | 4388+100n |
| | [Cd.149] | Deceleration time at continuous operation to torque control mode | 4389+100n |
| | [Cd.150] | Target torque at continuous operation to torque control mode | 4390+100n |
| | [Cd.151] | Torque time constant at continuous operation to torque control mode (Forward direction) | 4391+100n |
| | [Cd.152] | Torque time constant at continuous operation to torque control mode (Negative direction) | 4392+100n |
| | [Cd.153] | Control mode auto-shift selection | 4393+100n |
| | [Cd.154] | Control mode auto-shift parameter | 4394+100n<br>4395+100n |
| | [Cd.180] | Axis stop | 30100+10n |
| | [Cd.181] | Forward run JOG start | 30101+10n |
| | [Cd.182] | Reverse run JOG start | 30102+10n |
| | [Cd.183] | Execution prohibition flag | 30103+10n |
| System control data | [Cd.1] | Flash ROM write request | 5900 |
| | [Cd.2] | Parameter initialization request | 5901 |
| | [Cd.41] | Deceleration start flag valid | 5905 |
| | [Cd.42] | Stop command processing for deceleration stop selection | 5907 |
| | [Cd.44] | External input signal operation device (Axis 1 to 16) | 5928<br>5929<br>5930<br>5931 |
| | [Cd.102] | SSCNET control command | 5932 |
| | [Cd.137] | Amplifier-less operation mode switching request | 5926 |

## Positioning data

n: Axis No. - 1

| Memory area | | Item | | | Buffer memory address |
|---|---|---|---|---|---|
| Positioning data | Positioning data No.1 | [Da.1] | Operation pattern | Positioning identifier | 6000+1000n |
| | | [Da.2] | Control method | | |
| | | [Da.3] | Acceleration time No. | | |
| | | [Da.4] | Deceleration time No. | | |
| | | [Da.6] | Positioning address/movement amount | | 6006+1000n<br>6007+1000n |
| | | [Da.7] | Arc address | | 6008+1000n<br>6009+1000n |
| | | [Da.8] | Command speed | | 6004+1000n<br>6005+1000n |
| | | [Da.9] | Dwell time/JUMP destination positioning data No. | | 6002+1000n |
| | | [Da.10] | M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches | | 6001+1000n |
| | | [Da.20] | Axis to be interpolated No.1 | Axis to be interpolated | 71000+1000n<br>71001+1000n |
| | | [Da.21] | Axis to be interpolated No.2 | | |
| | | [Da.22] | Axis to be interpolated No.3 | | |
| | | [Da.27] | M code ON signal output timing | Positioning option | 6003+1000n |
| | | [Da.28] | ABS direction in degrees | | |
| | | [Da.29] | Interpolation speed designation method | | |

| Memory area | Item | Buffer memory address |
|---|---|---|
| Positioning data | No.2 | 6010+1000n<br>⋮<br>6019+1000n<br>71010+1000n<br>71011+1000n |
| | No.3 | 6020+1000n<br>⋮<br>6029+1000n<br>71020+1000n<br>71021+1000n |
| | ⋮ | ⋮ |
| | No.100 | 6990+1000n<br>⋮<br>6999+1000n<br>71990+1000n<br>71991+1000n |
| | No.101 | Set with the engineering tool. |
| | ⋮ | |
| | No.600 | |

## Block start data

n: Axis No. - 1

| Memory area | | | Item | | | Buffer memory address | |
|---|---|---|---|---|---|---|---|
| Positioning data (Starting block data) | Starting block 0 | Block start data 1st point | [Da.11]<br>[Da.12] | Shape<br>Start data No. | | 22000+400n | — |
| | | | [Da.13]<br>[Da.14] | Special start instruction<br>Parameter | | — | 22050+400n |
| | Starting block 0 | | 2nd point | | | 22001+400n | 22051+400n |
| | | | 3rd point | | | 22002+400n | 22052+400n |
| | | | ⋮ | | | ⋮ | |
| | | | 50th point | | | 22049+400n | 22099+400n |
| | Starting block 0 | Condition data No.1 | [Da.15] | Condition target | | 22100+400n | |
| | | | [Da.16] | Condition operator | | | |
| | | | [Da.17] | Address | | 22102+400n<br>22103+400n | |
| | | | [Da.18] | Parameter 1 | | 22104+400n<br>22105+400n | |
| | | | [Da.19] | Parameter 2 | | 22106+400n<br>22107+400n | |
| | | | [Da.23] | Number of simultaneously starting axes | Simultaneously starting axis | 22108+400n<br>22109+400n | |
| | | | [Da.24] | Simultaneously starting axis No.1 | | | |
| | | | [Da.25] | Simultaneously starting axis No.2 | | | |
| | | | [Da.26] | Simultaneously starting axis No.3 | | | |
| | Starting block 0 | | Condition data No.2 | | | 22110+400n<br>⋮<br>22119+400n | |
| | | | Condition data No.3 | | | 22120+400n<br>⋮<br>22129+400n | |
| | | | ⋮ | | | ⋮ | |
| | | | Condition data No.10 | | | 22190+400n<br>⋮<br>22199+400n | |

| Memory area | | | Item | Buffer memory address |
|---|---|---|---|---|
| Positioning data (Starting block data) | Starting block 1 | | Block start data | 22200+400n<br>⋮<br>22299+400n |
| | | | Condition data | 22300+400n<br>⋮<br>22399+400n |
| | Starting block 2 | | Block start data | Set with the engineering tool. |
| | | | Condition data | |
| | Starting block 3 | | Block start data | |
| | | | Condition data | |
| | Starting block 4 | | Block start data | |
| | | | Condition data | |
| Positioning data | | PLC CPU memo area | Condition judgment target data of the condition data | 30000 |
| | | | | ⋮ |
| | | | | 30099 |

The following shows the relation between the buffer memory addresses of servo parameter and the various items.
The setting range is different depending on the servo amplifier model. Refer to each servo amplifier instruction manual for details.
n: Axis No. - 1

| Memory area | Item | Servo amplifier parameter No. | Buffer memory address |
|---|---|---|---|
| Servo network composition parameters | [Pr.100] Connected device | — | 58020+32n<br>58021+32n |
| Servo parameters | — | PA01 | 28401+100n |
| | — | PA02 | 28402+100n |
| | — | PA03 | 28403+100n |
| | — | PA04 | 28404+100n |
| | — | PA05 | 28405+100n |
| | — | PA06 | 28406+100n |
| | — | PA07 | 28407+100n |
| | — | PA08 | 28408+100n |
| | — | PA09 | 28409+100n |
| | — | PA10 | 28410+100n |
| | — | PA11 | 28411+100n |
| | — | PA12 | 28412+100n |
| | — | PA13 | 28413+100n |
| | — | PA14 | 28414+100n |
| | — | PA15 | 28415+100n |
| | — | PA16 | 28416+100n |
| | — | PA17 | 28417+100n |
| | — | PA18 | 28418+100n |
| | — | PA19 | 64464+70n |
| | — | PA20 | 64400+70n |
| | — | PA21 | 64401+70n |
| | — | PA22 | 64402+70n |
| | — | PA23 | 64403+70n |
| | — | PA24 | 64404+70n |
| | — | PA25 | 64405+70n |
| | — | PA26 | 64406+70n |
| | — | PA27 | 64407+70n |
| | — | PA28 | 64408+70n |
| | — | PA29 | 64409+70n |
| | — | PA30 | 64410+70n |
| | — | PA31 | 64411+70n |
| | — | PA32 | 64412+70n |
| | — | PB01 | 28419+100n |
| | — | PB02 | 28420+100n |
| | — | PB03 | 28421+100n |
| | — | PB04 | 28422+100n |
| | — | PB05 | 28423+100n |
| | — | PB06 | 28424+100n |
| | — | PB07 | 28425+100n |
| | — | PB08 | 28426+100n |
| | — | PB09 | 28427+100n |
| | — | PB10 | 28428+100n |
| | — | PB11 | 28429+100n |
| | — | PB12 | 28430+100n |
| | — | PB13 | 28431+100n |
| | — | PB14 | 28432+100n |
| | — | PB15 | 28433+100n |

| Memory area | Item | Servo amplifier parameter No. | Buffer memory address |
|---|---|---|---|
| Servo parameters | — | PB16 | 28434+100n |
| | — | PB17 | 28435+100n |
| | — | PB18 | 28436+100n |
| | — | PB19 | 28437+100n |
| | — | PB20 | 28438+100n |
| | — | PB21 | 28439+100n |
| | — | PB22 | 28440+100n |
| | — | PB23 | 28441+100n |
| | — | PB24 | 28442+100n |
| | — | PB25 | 28443+100n |
| | — | PB26 | 28444+100n |
| | — | PB27 | 28445+100n |
| | — | PB28 | 28446+100n |
| | — | PB29 | 28447+100n |
| | — | PB30 | 28448+100n |
| | — | PB31 | 28449+100n |
| | — | PB32 | 28450+100n |
| | — | PB33 | 28451+100n |
| | — | PB34 | 28452+100n |
| | — | PB35 | 28453+100n |
| | — | PB36 | 28454+100n |
| | — | PB37 | 28455+100n |
| | — | PB38 | 28456+100n |
| | — | PB39 | 28457+100n |
| | — | PB40 | 28458+100n |
| | — | PB41 | 28459+100n |
| | — | PB42 | 28460+100n |
| | — | PB43 | 28461+100n |
| | — | PB44 | 28462+100n |
| | — | PB45 | 28463+100n |
| | — | PB46 | 64413+70n |
| | — | PB47 | 64414+70n |
| | — | PB48 | 64415+70n |
| | — | PB49 | 64416+70n |
| | — | PB50 | 64417+70n |
| | — | PB51 | 64418+70n |
| | — | PB52 | 64419+70n |
| | — | PB53 | 64420+70n |
| | — | PB54 | 64421+70n |
| | — | PB55 | 64422+70n |
| | — | PB56 | 64423+70n |
| | — | PB57 | 64424+70n |
| | — | PB58 | 64425+70n |
| | — | PB59 | 64426+70n |
| | — | PB60 | 64427+70n |
| | — | PB61 | 64428+70n |
| | — | PB62 | 64429+70n |
| | — | PB63 | 64430+70n |
| | — | PB64 | 64431+70n |
| | — | PC01 | 28464+100n |
| | — | PC02 | 28465+100n |
| | — | PC03 | 28466+100n |

| Memory area | Item | Servo amplifier parameter No. | Buffer memory address |
|---|---|---|---|
| Servo parameters | — | PC04 | 28467+100n |
| | — | PC05 | 28468+100n |
| | — | PC06 | 28469+100n |
| | — | PC07 | 28470+100n |
| | — | PC08 | 28471+100n |
| | — | PC09 | 28472+100n |
| | — | PC10 | 28473+100n |
| | — | PC11 | 28474+100n |
| | — | PC12 | 28475+100n |
| | — | PC13 | 28476+100n |
| | — | PC14 | 28477+100n |
| | — | PC15 | 28478+100n |
| | — | PC16 | 28479+100n |
| | — | PC17 | 28480+100n |
| | — | PC18 | 28481+100n |
| | — | PC19 | 28482+100n |
| | — | PC20 | 28483+100n |
| | — | PC21 | 28484+100n |
| | — | PC22 | 28485+100n |
| | — | PC23 | 28486+100n |
| | — | PC24 | 28487+100n |
| | — | PC25 | 28488+100n |
| | — | PC26 | 28489+100n |
| | — | PC27 | 28490+100n |
| | — | PC28 | 28491+100n |
| | — | PC29 | 28492+100n |
| | — | PC30 | 28493+100n |
| | — | PC31 | 28494+100n |
| | — | PC32 | 28495+100n |
| | — | PC33 | 64432+70n |
| | — | PC34 | 64433+70n |
| | — | PC35 | 64434+70n |
| | — | PC36 | 64435+70n |
| | — | PC37 | 64436+70n |
| | — | PC38 | 64437+70n |
| | — | PC39 | 64438+70n |
| | — | PC40 | 64439+70n |
| | — | PC41 | 64440+70n |
| | — | PC42 | 64441+70n |
| | — | PC43 | 64442+70n |
| | — | PC44 | 64443+70n |
| | — | PC45 | 64444+70n |
| | — | PC46 | 64445+70n |
| | — | PC47 | 64446+70n |
| | — | PC48 | 64447+70n |
| | — | PC49 | 64448+70n |
| | — | PC50 | 64449+70n |
| | — | PC51 | 64450+70n |
| | — | PC52 | 64451+70n |
| | — | PC53 | 64452+70n |
| | — | PC54 | 64453+70n |
| | — | PC55 | 64454+70n |

| Memory area | Item | Servo amplifier parameter No. | Buffer memory address |
|---|---|---|---|
| Servo parameters | — | PC56 | 64455+70n |
| | — | PC57 | 64456+70n |
| | — | PC58 | 64457+70n |
| | — | PC59 | 64458+70n |
| | — | PC60 | 64459+70n |
| | — | PC61 | 64460+70n |
| | — | PC62 | 64461+70n |
| | — | PC63 | 64462+70n |
| | — | PC64 | 64463+70n |
| | — | PD01 | 65520+340n |
| | — | PD02 | 65521+340n |
| | — | PD03 | 65522+340n |
| | — | PD04 | 65523+340n |
| | — | PD05 | 65524+340n |
| | — | PD06 | 65525+340n |
| | — | PD07 | 65526+340n |
| | — | PD08 | 65527+340n |
| | — | PD09 | 65528+340n |
| | — | PD10 | 65529+340n |
| | — | PD11 | 65530+340n |
| | — | PD12 | 65531+340n |
| | — | PD13 | 65532+340n |
| | — | PD14 | 65533+340n |
| | — | PD15 | 65534+340n |
| | — | PD16 | 65535+340n |
| | — | PD17 | 65536+340n |
| | — | PD18 | 65537+340n |
| | — | PD19 | 65538+340n |
| | — | PD20 | 65539+340n |
| | — | PD21 | 65540+340n |
| | — | PD22 | 65541+340n |
| | — | PD23 | 65542+340n |
| | — | PD24 | 65543+340n |
| | — | PD25 | 65544+340n |
| | — | PD26 | 65545+340n |
| | — | PD27 | 65546+340n |
| | — | PD28 | 65547+340n |
| | — | PD29 | 65548+340n |
| | — | PD30 | 65549+340n |
| | — | PD31 | 65550+340n |
| | — | PD32 | 65551+340n |
| | — | PD33 | 65552+340n |
| | — | PD34 | 65553+340n |
| | — | PD35 | 65554+340n |
| | — | PD36 | 65555+340n |
| | — | PD37 | 65556+340n |
| | — | PD38 | 65557+340n |
| | — | PD39 | 65558+340n |
| | — | PD40 | 65559+340n |
| | — | PD41 | 65560+340n |
| | — | PD42 | 65561+340n |
| | — | PD43 | 65562+340n |

| Memory area | Item | Servo amplifier parameter No. | Buffer memory address |
|---|---|---|---|
| Servo parameters | — | PD44 | 65563+340n |
| | — | PD45 | 65564+340n |
| | — | PD46 | 65565+340n |
| | — | PD47 | 65566+340n |
| | — | PD48 | 65567+340n |
| | — | PE01 | 65568+340n |
| | — | PE02 | 65569+340n |
| | — | PE03 | 65570+340n |
| | — | PE04 | 65571+340n |
| | — | PE05 | 65572+340n |
| | — | PE06 | 65573+340n |
| | — | PE07 | 65574+340n |
| | — | PE08 | 65575+340n |
| | — | PE09 | 65576+340n |
| | — | PE10 | 65577+340n |
| | — | PE11 | 65578+340n |
| | — | PE12 | 65579+340n |
| | — | PE13 | 65580+340n |
| | — | PE14 | 65581+340n |
| | — | PE15 | 65582+340n |
| | — | PE16 | 65583+340n |
| | — | PE17 | 65584+340n |
| | — | PE18 | 65585+340n |
| | — | PE19 | 65586+340n |
| | — | PE20 | 65587+340n |
| | — | PE21 | 65588+340n |
| | — | PE22 | 65589+340n |
| | — | PE23 | 65590+340n |
| | — | PE24 | 65591+340n |
| | — | PE25 | 65592+340n |
| | — | PE26 | 65593+340n |
| | — | PE27 | 65594+340n |
| | — | PE28 | 65595+340n |
| | — | PE29 | 65596+340n |
| | — | PE30 | 65597+340n |
| | — | PE31 | 65598+340n |
| | — | PE32 | 65599+340n |
| | — | PE33 | 65600+340n |
| | — | PE34 | 65601+340n |
| | — | PE35 | 65602+340n |
| | — | PE36 | 65603+340n |
| | — | PE37 | 65604+340n |
| | — | PE38 | 65605+340n |
| | — | PE39 | 65606+340n |
| | — | PE40 | 65607+340n |
| | — | PE41 | 65608+340n |
| | — | PE42 | 65609+340n |
| | — | PE43 | 65610+340n |
| | — | PE44 | 65611+340n |
| | — | PE45 | 65612+340n |
| | — | PE46 | 65613+340n |
| | — | PE47 | 65614+340n |

| Memory area | Item | Servo amplifier parameter No. | Buffer memory address |
|---|---|---|---|
| Servo parameters | — | PE48 | 65615+340n |
| | — | PE49 | 65616+340n |
| | — | PE50 | 65617+340n |
| | — | PE51 | 65618+340n |
| | — | PE52 | 65619+340n |
| | — | PE53 | 65620+340n |
| | — | PE54 | 65621+340n |
| | — | PE55 | 65622+340n |
| | — | PE56 | 65623+340n |
| | — | PE57 | 65624+340n |
| | — | PE58 | 65625+340n |
| | — | PE59 | 65626+340n |
| | — | PE60 | 65627+340n |
| | — | PE61 | 65628+340n |
| | — | PE62 | 65629+340n |
| | — | PE63 | 65630+340n |
| | — | PE64 | 65631+340n |
| | — | PS01 | 65712+340n |
| | — | PS02 | 65713+340n |
| | — | PS03 | 65714+340n |
| | — | PS04 | 65715+340n |
| | — | PS05 | 65716+340n |
| | — | PS06 | 65717+340n |
| | — | PS07 | 65718+340n |
| | — | PS08 | 65719+340n |
| | — | PS09 | 65720+340n |
| | — | PS10 | 65721+340n |
| | — | PS11 | 65722+340n |
| | — | PS12 | 65723+340n |
| | — | PS13 | 65724+340n |
| | — | PS14 | 65725+340n |
| | — | PS15 | 65726+340n |
| | — | PS16 | 65727+340n |
| | — | PS17 | 65728+340n |
| | — | PS18 | 65729+340n |
| | — | PS19 | 65730+340n |
| | — | PS20 | 65731+340n |
| | — | PS21 | 65732+340n |
| | — | PS22 | 65733+340n |
| | — | PS23 | 65734+340n |
| | — | PS24 | 65735+340n |
| | — | PS25 | 65736+340n |
| | — | PS26 | 65737+340n |
| | — | PS27 | 65738+340n |
| | — | PS28 | 65739+340n |
| | — | PS29 | 65740+340n |
| | — | PS30 | 65741+340n |
| | — | PS31 | 65742+340n |
| | — | PS32 | 65743+340n |

| Memory area | Item | Servo amplifier parameter No. | Buffer memory address |
|---|---|---|---|
| Servo parameters | — | PF01 | 65632+340n |
| | — | PF02 | 65633+340n |
| | — | PF03 | 65634+340n |
| | — | PF04 | 65635+340n |
| | — | PF05 | 65636+340n |
| | — | PF06 | 65637+340n |
| | — | PF07 | 65638+340n |
| | — | PF08 | 65639+340n |
| | — | PF09 | 65640+340n |
| | — | PF10 | 65641+340n |
| | — | PF11 | 65642+340n |
| | — | PF12 | 65643+340n |
| | — | PF13 | 65644+340n |
| | — | PF14 | 65645+340n |
| | — | PF15 | 65646+340n |
| | — | PF16 | 65647+340n |
| | — | PF17 | 65648+340n |
| | — | PF18 | 65649+340n |
| | — | PF19 | 65650+340n |
| | — | PF20 | 65651+340n |
| | — | PF21 | 65652+340n |
| | — | PF22 | 65653+340n |
| | — | PF23 | 65654+340n |
| | — | PF24 | 65655+340n |
| | — | PF25 | 65656+340n |
| | — | PF26 | 65657+340n |
| | — | PF27 | 65658+340n |
| | — | PF28 | 65659+340n |
| | — | PF29 | 65660+340n |
| | — | PF30 | 65661+340n |
| | — | PF31 | 65662+340n |
| | — | PF32 | 65663+340n |
| | — | PF33 | 65664+340n |
| | — | PF34 | 65665+340n |
| | — | PF35 | 65666+340n |
| | — | PF36 | 65667+340n |
| | — | PF37 | 65668+340n |
| | — | PF38 | 65669+340n |
| | — | PF39 | 65670+340n |
| | — | PF40 | 65671+340n |
| | — | PF41 | 65672+340n |
| | — | PF42 | 65673+340n |
| | — | PF43 | 65674+340n |
| | — | PF44 | 65675+340n |
| | — | PF45 | 65676+340n |
| | — | PF46 | 65677+340n |
| | — | PF47 | 65678+340n |
| | — | PF48 | 65679+340n |
| | — | Po01 | 65680+340n |
| | — | Po02 | 65681+340n |
| | — | Po03 | 65682+340n |
| | — | Po04 | 65683+340n |

| Memory area | Item | Servo amplifier parameter No. | Buffer memory address |
|---|---|---|---|
| Servo parameters | — | Po05 | 65684+340n |
| | — | Po06 | 65685+340n |
| | — | Po07 | 65686+340n |
| | — | Po08 | 65687+340n |
| | — | Po09 | 65688+340n |
| | — | Po10 | 65689+340n |
| | — | Po11 | 65690+340n |
| | — | Po12 | 65691+340n |
| | — | Po13 | 65692+340n |
| | — | Po14 | 65693+340n |
| | — | Po15 | 65694+340n |
| | — | Po16 | 65695+340n |
| | — | Po17 | 65696+340n |
| | — | Po18 | 65697+340n |
| | — | Po19 | 65698+340n |
| | — | Po20 | 65699+340n |
| | — | Po21 | 65700+340n |
| | — | Po22 | 65701+340n |
| | — | Po23 | 65702+340n |
| | — | Po24 | 65703+340n |
| | — | Po25 | 65704+340n |
| | — | Po26 | 65705+340n |
| | — | Po27 | 65706+340n |
| | — | Po28 | 65707+340n |
| | — | Po29 | 65708+340n |
| | — | Po30 | 65709+340n |
| | — | Po31 | 65710+340n |
| | — | Po32 | 65711+340n |
| | — | PL01 | 65744+340n |
| | — | PL02 | 65745+340n |
| | — | PL03 | 65746+340n |
| | — | PL04 | 65747+340n |
| | — | PL05 | 65748+340n |
| | — | PL06 | 65749+340n |
| | — | PL07 | 65750+340n |
| | — | PL08 | 65751+340n |
| | — | PL09 | 65752+340n |
| | — | PL10 | 65753+340n |
| | — | PL11 | 65754+340n |
| | — | PL12 | 65755+340n |
| | — | PL13 | 65756+340n |
| | — | PL14 | 65757+340n |
| | — | PL15 | 65758+340n |
| | — | PL16 | 65759+340n |
| | — | PL17 | 65760+340n |
| | — | PL18 | 65761+340n |
| | — | PL19 | 65762+340n |
| | — | PL20 | 65763+340n |
| | — | PL21 | 65764+340n |
| | — | PL22 | 65765+340n |
| | — | PL23 | 65766+340n |
| | — | PL24 | 65767+340n |

| Memory area | Item | Servo amplifier parameter No. | Buffer memory address |
|---|---|---|---|
| Servo parameters | — | PL25 | 65768+340n |
| | — | PL26 | 65769+340n |
| | — | PL27 | 65770+340n |
| | — | PL28 | 65771+340n |
| | — | PL29 | 65772+340n |
| | — | PL30 | 65773+340n |
| | — | PL31 | 65774+340n |
| | — | PL32 | 65775+340n |
| | — | PL33 | 65776+340n |
| | — | PL34 | 65777+340n |
| | — | PL35 | 65778+340n |
| | — | PL36 | 65779+340n |
| | — | PL37 | 65780+340n |
| | — | PL38 | 65781+340n |
| | — | PL39 | 65782+340n |
| | — | PL40 | 65783+340n |
| | — | PL41 | 65784+340n |
| | — | PL42 | 65785+340n |
| | — | PL43 | 65786+340n |
| | — | PL44 | 65787+340n |
| | — | PL45 | 65788+340n |
| | — | PL46 | 65789+340n |
| | — | PL47 | 65790+340n |
| | — | PL48 | 65791+340n |

The following shows the relation between the buffer memory addresses for mark detection function and the various items.
k: Mark detection setting No. - 1

| Memory area | Item | | | Buffer memory address |
|---|---|---|---|---|
| Mark detection setting parameters | [Pr.800] | Mark detection signal setting | | 54000+20k |
| | [Pr.801] | Mark detection signal compensation time | | 54001+20k |
| | [Pr.802] | Mark detection data type | | 54002+20k |
| | [Pr.803] | Mark detection data axis No. | | 54003+20k |
| | [Pr.804] | Mark detection data buffer memory No. | | 54004+20k<br>54005+20k |
| | [Pr.805] | Latch data range upper limit value | | 54006+20k<br>54007+20k |
| | [Pr.806] | Latch data range lower limit value | | 54008+20k<br>54009+20k |
| | [Pr.807] | Mark detection mode setting | | 54010+20k |
| Mark detection control data | [Cd.800] | Number of mark detection clear request | | 54640+10k |
| | [Cd.801] | Mark detection invalid flag | | 54641+10k |
| | [Cd.802] | Latch data range change request | | 54642+10k |
| Mark detection monitor data | [Md.800] | Number of mark detection | | 54960+80k |
| | [Md.801] | Mark detection data storage area (1 to 32) | 1 | 54962+80k<br>54963+80k |
| | | | 2 | 54964+80k<br>54965+80k |
| | | | 3 | 54966+80k<br>54967+80k |
| | | | ⋮ | ⋮ |
| | | | 32 | 55024+80k<br>55025+80k |

# 12.3 Basic Setting

The setting items of the positioning parameter, home position return parameter or servo parameter are explained in this section.

## Servo network composition parameters

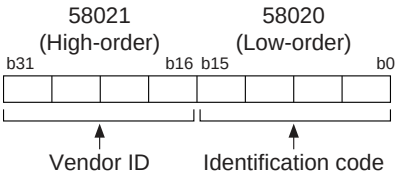
### Connected device

n: Axis No. - 1

| Item | | Setting details | Setting range | Default value | Buffer memory address |
|---|---|---|---|---|---|
| [Pr.100] | Connected device | Used to select the SSCNET device to connect to the Simple Motion module.<br>[POINT]<br>• Be sure to set up the connected device. Communication with the SSCNET device is not started by the initial value "0" in default value. | ☞ Page 407<br>Identification code list | 0 | 58020+32n<br>58021+32n |

When the setting value which is different from the connected device is set, the error "Connected device setting error" (error code: 193EH) occurs. When connecting with the connected device with the setting value other than above, the warning "Incompatible device" (warning code: 0C81H) occurs.

### Identification code list




Mitsubishi electric (Vendor ID: 0000)

| Identification code | Model | Remark | Network |
|---|---|---|---|
| 0100 | MR-J3-_B, MR-J3W-_B (2-axis type) | | SSCNETⅢ |
| 0101 | MR-J3-_B-RJ006 (For fully closed loop control) | | SSCNETⅢ |
| 0102 | MR-J3-_B-RJ004 (For linear servo motor) | | SSCNETⅢ |
| 0107 | MR-J3-_B-RJ080W (For direct drive motor) | | SSCNETⅢ |
| 0180 | MR-J3W-0303BN6 | | SSCNETⅢ |
| 4100 | FR-A700 (Inverter) | Inverter | SSCNETⅢ |
| 4101 | FR-A700-NA (Inverter) | Inverter | SSCNETⅢ |
| 4102 | FR-A700-EC (Inverter) | Inverter | SSCNETⅢ |
| 4103 | FR-A700-CHT (Inverter) | Inverter | SSCNETⅢ |
| 0FFF | Virtual servo amplifier (MR-J3-B Standard) | | SSCNETⅢ |
| 1000 | MR-J4-_B, MR-J4W-_B (2-, 3-axis type) | | SSCNETⅢ/H |
| 1200 | MR-JE-B | | SSCNETⅢ/H |
| 1FFF | Virtual servo amplifier (MR-J4-B) | | SSCNETⅢ/H |

Nikki Denso (Vendor ID: 0008)

| Identification code | Model | Remark | Network |
|---|---|---|---|
| 0102 | VCⅡ (Manufactured by Nikki Denso Co., Ltd.) (For linear stage) | | SSCNETⅢ |
| 0107 | VCⅡ (Manufactured by Nikki Denso Co., Ltd.) (For direct drive motor) | | SSCNETⅢ |
| 1000 | VCⅡ (Manufactured by Nikki Denso Co., Ltd.) | | SSCNETⅢ/H |

# Common parameters

| Item | Setting value, setting range | | Default value | Buffer memory address |
|---|---|---|---|---|
| | Value set with the engineering tool | Value set with a program | | |
| [Pr.24] Manual pulse generator/Incremental synchronous encoder input selection | 0: A-phase/B-phase multiplied by 4 | 0 | 0 | 33 |
| | 1: A-phase/B-phase multiplied by 2 | 1 | | |
| | 2: A-phase/B-phase multiplied by 1 | 2 | | |
| | 3: PULSE/SIGN | 3 | | |
| [Pr.82] Forced stop valid/ invalid selection | 0: Valid | 0 | 0 | 35 |
| | 1: Invalid | 1 | | |
| [Pr.89] Manual pulse generator/Incremental synchronous encoder input type selection | 0: Differential output type | 0 | 1 | 67 |
| | 1: Voltage output/open collector type | 1 | | |
| [Pr.96] Operation cycle setting | 0000H: 0.888 ms | 0000H | FFFFH | 105 |
| | 0001H: 1.777 ms | 0001H | | |
| | 0002H: 3.555 ms | 0002H | | |
| | 0200H: 0.444 ms | 0200H | | |
| | FFFFH: Automatic setting | FFFFH | | |
| [Pr.97] SSCNET setting | 0: SSCNETⅢ | 0 | 1 | 106 |
| | 1: SSCNETⅢ/H | 1 | | |
| [Pr.150] Input terminal logic selection | b0: SIN1 to b19: SIN20 — 0: ON at leading edge; 1: ON at trailing edge | 0<br>1 | 0 | 58000, 58001 |
| [Pr.151] Manual pulse generator/Incremental synchronous encoder input logic selection | 0: Negative logic | 0 | 0 | 58002 |
| | 1: Positive logic | 1 | | |
| [Pr.152] Maximum number of control axes | 0: No setting | 0 | 0 | 58003 |
| | 1 to 16: Maximum number of control axes | 1 to 16 | | |
| [Pr.153] External input signal digital filter setting | 0H: 3.2 ms | 0H | 6666H | 58004<br>58005<br>58006<br>58007<br>58008 |
| | 1H: 2.4 ms | 1H | | |
| | 2H: 1.6 ms | 2H | | |
| | 3H: 1.2 ms | 3H | | |
| | 4H: 0.8 ms | 4H | | |
| | 5H: 0.4 ms | 5H | | |
| | 6H: 0.2 ms | 6H | | |

## [Pr.24] Manual pulse generator/Incremental synchronous encoder input selection

Set the manual pulse generator/incremental synchronous encoder input pulse mode.

| Manual pulse generator/Incremental synchronous encoder input selection | Setting value |
|---|---|
| A-phase/B-phase multiplied by 4 | 0 |
| A-phase/B-phase multiplied by 2 | 1 |
| A-phase/B-phase multiplied by 1 | 2 |
| PULSE/SIGN | 3 |

Set the positive logic or negative logic in "[Pr.151] Manual pulse generator/Incremental synchronous encoder input logic selection".

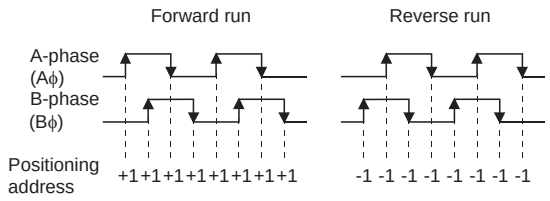
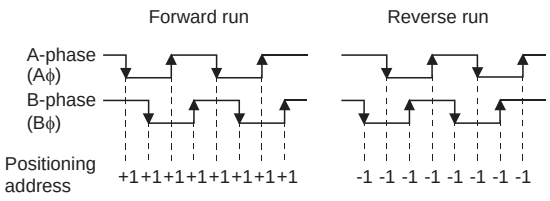
### ■A-phase/B-phase mode

When the A-phase is 90° ahead of the B-phase, the motor will forward run.

When the B-phase is 90° ahead of the A-phase, the motor will reverse run.

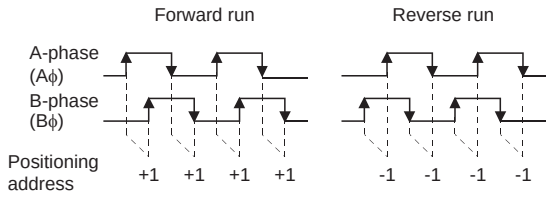
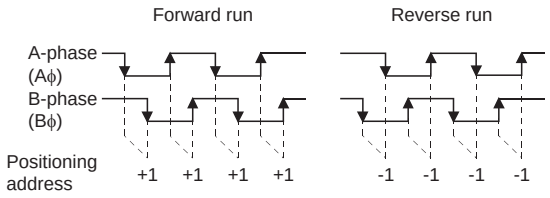
- A-phase/B-phase multiplied by 4

The positioning address increases or decreases at rising or falling edges of A-phase/B-phase.

| [Pr.151] Manual pulse generator/Incremental synchronous encoder input logic selection | |
|---|---|
| **Positive logic** | **Negative logic** |
|  |  |

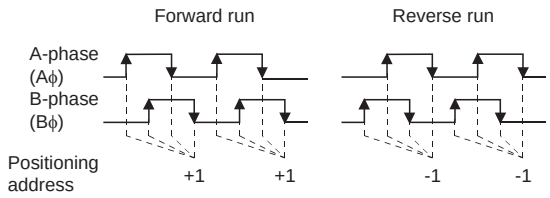
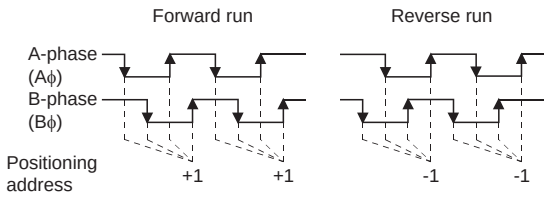
- A-phase/B-phase multiplied by 2

The positioning address increases or decreases at twice rising or twice falling edges of A-phase/B-phase.

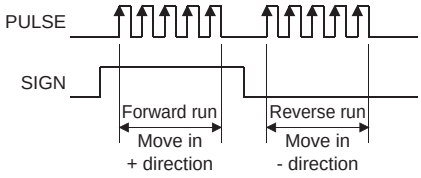
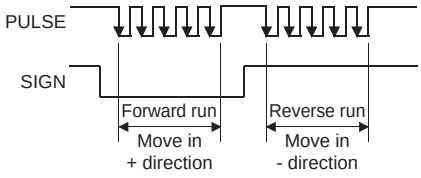
| [Pr.151] Manual pulse generator/Incremental synchronous encoder input logic selection | |
|---|---|
| **Positive logic** | **Negative logic** |
|  |  |

- A-phase/B-phase multiplied by 1

The positioning address increases or decreases at twice rising or twice falling edges of A-phase/B-phase.

| [Pr.151] Manual pulse generator/Incremental synchronous encoder input logic selection | |
|---|---|
| **Positive logic** | **Negative logic** |
|  |  |

## ■PULSE/SIGN

| [Pr.151] Manual pulse generator/Incremental synchronous encoder input logic selection | |
|---|---|
| **Positive logic** | **Negative logic** |
| Forward run and reverse run are controlled with the ON/OFF of the direction sign (SIGN).<br>The motor will forward run when the direction sign is HIGH.<br>The motor will reverse run when the direction sign is LOW. | Forward run and reverse run are controlled with the ON/OFF of the direction sign (SIGN).<br>The motor will forward run when the direction sign is LOW.<br>The motor will reverse run when the direction sign is HIGH. |
|  |  |

## [Pr.82] Forced stop valid/invalid selection

Set the forced stop valid/invalid.

All axes of the servo amplifier are made to batch forced stop when the forced stop input signal is turned on. The error "Servo READY signal OFF during operation" (error code: 1902H) does not occur if the forced input signal is turned on during operation.

| Forced stop valid/invalid selection | Setting value |
|---|---|
| Valid (Forced stop is used.) | 0 |
| Invalid (Forced stop is not used.) | 1 |

**Point**

- If the setting is other than 0 and 1, the error "Forced stop valid/invalid setting error" (error code: 1B71H) occurs.
- The "[Md.50] Forced stop input" is stored "1" by setting "Forced stop valid/invalid selection" to invalid.

## [Pr.89] Manual pulse generator/Incremental synchronous encoder input type selection

Set the input type from the manual pulse generator/incremental synchronous encoder.

| Manual pulse generator/Incremental synchronous encoder input type selection | Setting value |
|---|---|
| Differential output type | 0 |
| Voltage output/open collector type | 1 |

Refer to the following for details.

MELSEC iQ-R Simple Motion Module User's Manual (Startup)

**Point**

The "Manual pulse generator/Incremental synchronous encoder input type selection" is included in common parameters. However, it will be valid at the leading edge (OFF to ON) of the PLC READY signal [Y0].

## [Pr.96] Operation cycle setting

Set the operation cycle.

| Operation cycle setting | Setting value |
|---|---|
| 0.888 ms | 0000H |
| 1.777 ms | 0001H |
| 3.555 ms | 0002H |
| 0.444 ms*1 | 0200H |
| Automatic setting | FFFFH |

The default value is "FFFFH: Automatic setting".

*1 Available only when "1: SSCNETⅢ/H" is set in "[Pr.97] SSCNET setting". If "0: SSCNETⅢ" is set, the error "Operation cycle setting error" (error code: 1B73H) occurs.

**Point**

- In this parameter, the value set in flash ROM of Simple Motion module is valid at power supply ON or CPU module reset. Fetch by PLC READY signal OFF to ON is not executed. Execute flash ROM writing to change after setting a value to buffer memory. Confirm the current operation cycle in "[Md.132] Operation cycle setting".
- When "FFFFH: Automatic setting" is set, the optimum operation cycle is set according to "[Pr.152] Maximum number of control axes". Confirm the set operation cycle in "[Md.132] Operation cycle setting".*1
- Confirm that "[Md.133] Operation cycle over flag" does not turn ON. If the flag is ON, the operation cycle over has been generated. Correct the positioning content or increase the operation cycle.

*1 "[Md.133] Operation cycle over flag" may turn ON depending on the positioning content.

## [Pr.97] SSCNET setting

Set the servo network.

| SSCNET setting | Setting value |
|---|---|
| SSCNETⅢ | 0 |
| SSCNETⅢ/H | 1 |

The connectable servo amplifier differs by this parameter. When unconnectable connected device is set in "[Pr.100] Connected device", the warning "Incompatible device" (warning code: 0C81H) occurs at the power supply ON or PLC READY ON.

**Point**

In this parameter, the value set in flash ROM of Simple Motion module is valid at power supply ON or CPU module reset. Fetch by PLC READY signal OFF to ON is not executed. Execute flash ROM writing to change after setting a value to buffer memory.

## [Pr.150] Input terminal logic selection

Set the external input signal logic (upper/lower limit signal, stop signal, near-point dog signal, and external command/switching signal) from the external device of the Simple Motion module.

| Input terminal logic selection | Setting value |
|---|---|
| ON at leading edge (When the current is flowed through the input signal terminal: ON, When the current is not flowed through the input signal terminal: OFF) | 0 |
| ON at trailing edge (When the current is flowed through the input signal terminal: OFF, When the current is not flowed through the input signal terminal: ON) | 1 |

### ■RD77MS2

| Bit | Input terminal | Bit | Input terminal |
|---|---|---|---|
| b0 | SIN1 | b5 | SIN6 |
| b1 | SIN2 | b6 | SIN7 |
| b2 | SIN3 | b7 | SIN8 |
| b3 | SIN4 | b8 | SIN9 |
| b4 | SIN5 | b9 | SIN10 |

### ■RD77MS4/8/16

| Bit | Input terminal | Bit | Input terminal |
|---|---|---|---|
| b0 | SIN1 | b10 | SIN11 |
| b1 | SIN2 | b11 | SIN12 |
| b2 | SIN3 | b12 | SIN13 |
| b3 | SIN4 | b13 | SIN14 |
| b4 | SIN5 | b14 | SIN15 |
| b5 | SIN6 | b15 | SIN16 |
| b6 | SIN7 | b16 | SIN17 |
| b7 | SIN8 | b17 | SIN18 |
| b8 | SIN9 | b18 | SIN19 |
| b9 | SIN10 | b19 | SIN20 |

**Point**

A mismatch in the setting may disable normal operation. Be careful when changing the default value.

## [Pr.151] Manual pulse generator/INC synchronous encoder input logic selection

Set the input signal logic from the manual pulse generator/incremental synchronous encoder.

| Manual pulse generator/Incremental synchronous encoder input logic selection | Setting value |
|---|---|
| Negative logic | 0 |
| Positive logic | 1 |

Refer to the following for the negative logic/positive logic.

☞ Page 409 [Pr.24] Manual pulse generator/Incremental synchronous encoder input selection

**Point**

A mismatch in the signal logic will disable normal operation. Be careful of this when you change from the default value.

## [Pr.152] Maximum number of control axes

Set the maximum number of control axes.

| Maximum number of control axes | Setting value |
|---|---|
| No setting (Controls with the maximum number of control axes for each module.) | 0 |
| Maximum number of control axes (Controls the axes until the set axis No.) | 1 to 16 |

- When the maximum number of control axes exceeds the maximum number of control axes of the Simple Motion module (such as when setting "3" for the 2-axis module), the warning "Outside maximum number of control axes" (warning code: 093AH) occurs and the module is controlled as set with "0: No setting". (The warning occurs in the axis 1.)
- When "[Pr.100] Connected device" is set with a value other than "0: No setting" in the axis which is out of the maximum number of control axes, the warning "Outside control axis setting" (warning code: 093BH) occurs to these axes and the axes does not communicate with servo amplifiers. (The servo amplifier's LED display remains "Ab".)



**Point**

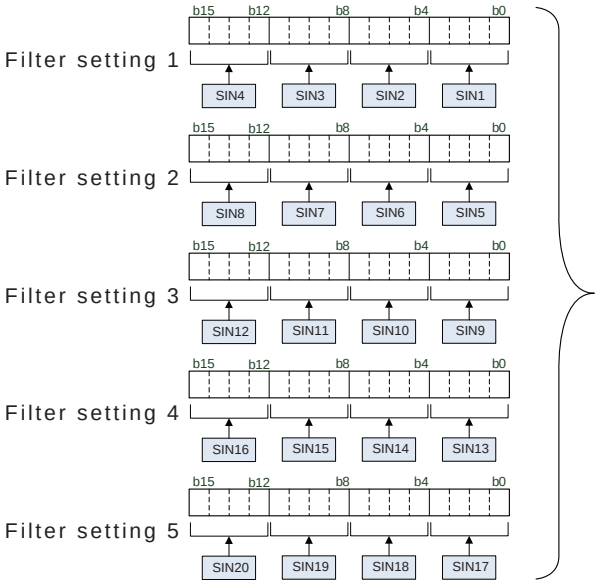
- In this parameter, the value set in flash ROM of Simple Motion module is valid at power supply ON or CPU module reset. Fetch by PLC READY signal OFF to ON is not executed. Execute flash ROM writing to change the value after setting a value to buffer memory. (It is necessary to establish the value at power supply ON or CPU module reset.)
- The servo input axis (synchronous control) and virtual servo amplifier of the axes which are out of the maximum number of control axes are out of the target.
- This parameter is used when the number of actual used control axes is less than the maximum number of control axes of each module and to suppress the operation cycle.

## [Pr.153] External input signal digital filter setting

Set the digital filter for each input signal (SIN1 to SIN20).

**Point**

- This parameter is used to suppress chattering when the external input signal is chattering by noise, etc.
- When lengthening the filter setting time, the signal detection timing will be slow.




0H: 3.2 ms
1H: 2.4 ms
2H: 1.6 ms
3H: 1.2 ms
4H: 0.8 ms
5H: 0.4 ms
6H: 0.2 ms

### ■Precaution

- When a value other than "0 to 6" is set, note that the module may cause a failure.

# Basic parameters1

This section describes the details on the basic parameter 1.

n: Axis No. - 1

| Item | | Setting value, setting range | | Default value | Buffer memory address |
|---|---|---|---|---|---|
| | | Value set with the engineering tool | Value set with a program | | |
| [Pr.1] Unit setting | | 0: mm | 0 | 3 | 0+150n |
| | | 1: inch | 1 | | |
| | | 2: degree | 2 | | |
| | | 3: pulse | 3 | | |
| Movement amount per pulse | [Pr.2] Number of pulses per rotation (AP) (Unit: pulse) | 1 to 200000000 | 1 to 200000000 | 20000 | 2+150n<br>3+150n |
| | [Pr.3] Movement amount per rotation (AL) | The setting value range differs according to the "[Pr.1] Unit setting". | | 20000 | 4+150n<br>5+150n |
| | [Pr.4] Unit magnification (AM) | 1: 1 times | 1 | 1 | 1+150n |
| | | 10: 10 times | 10 | | |
| | | 100: 100 times | 100 | | |
| | | 1000: 1000 times | 1000 | | |
| [Pr.7] Bias speed at start | | The setting value range differs according to the "[Pr.1] Unit setting". | | 0 | 6+150n<br>7+150n |

## [Pr.1] Unit setting

Set the unit used for defining positioning operations. Choose from the following units depending on the type of the control target: mm, inch, degree, or pulse. Different units can be defined for different axes.

Ex.

Different units (mm, inch, degree, and pulse) are applicable to different systems:

- mm or inch: X-Y table, conveyor (Select mm or inch depending on the machine specifications.)
- degree: Rotating body (360 degrees/rotation)
- pulse: X-Y table, conveyor

*1 When you change the unit, note that the values of other parameters and data will not be changed automatically. After changing the unit, check if the parameter and data values are within the allowable range. Set "degree" to exercise speed-position switching control (ABS mode).

## [Pr.2] to [Pr.4] Electronic gear (Movement amount per pulse)

Mechanical system value used when the Simple Motion module performs positioning control.

The settings are made using [Pr.2] to [Pr.4].

The electronic gear is expressed by the following equation.

$$\text{Electronic gear} = \frac{\text{Number of pulses per rotation (AP)}}{\text{Movement amount per rotation (AL)} \times \text{Unit magnification (AM)}}$$

*1 When positioning has been performed, an error (mechanical system error) may be produced between the specified movement amount and the actual movement amount.
The error can be compensated by adjusting the value set in electronic gear.
☞ Page 225 Electronic gear function

**Point**

- The result of below calculation (round up after decimal point) is a minimum pulse when the current feed value is updated at follow-up processing. (The movement amount for droop pulse is reflected as the current feed value when the droop pulse becomes more than above calculated value in pulse unit of motor end.)

Number of pulses per rotation (AP) / (Movement amount per rotation (AL) × Unit magnification (AM) × 3375) [pulse]

Refer to the following for the follow-up processing.

☞ Page 302 Follow up function

## [Pr.2] Number of pulses per rotation (AP)

Set the number of pulses required for a complete rotation of the motor shaft.

If you are using the Mitsubishi servo amplifier MR-J4(W)-B/MR-JE-B/MR-J3(W)-B, set the value given as the "resolution per servomotor rotation" in the speed/position detector specifications.

Number of pulses per rotation (AP) = Resolution per servomotor rotation

## [Pr.3] Movement amount per rotation (AL), [Pr.4] Unit magnification (AM)

The amount how the workpiece moves with one motor rotation is determined by the mechanical structure.

If the worm gear lead (μm/rev) is PB and the deceleration rate is 1/n, then

Movement amount per rotation (AL) = PB × 1/n

However, the maximum value that can be set for this "movement amount per rotation (AL)" parameter is 20000000.0 μm (20 m). Set the "movement amount per rotation (AL)" as shown below so that the "movement amount per rotation (AL)" does not exceed this maximum value.

Movement amount per rotation (AL)

= PB × 1/n

= Movement amount per rotation (AL) × Unit magnification (AM)*1

*1 The unit magnification (AM) is a value of 1, 10, 100 or 1000. If the "PB × 1/n" value exceeds 20000000.0 μm (20 m), adjust with the unit magnification so that the "movement amount per rotation (AL)" does not exceed 20000000.0 μm (20 m).

*2 Refer to the following for information about electric gear.

☞ Page 225 Electronic gear function

| [Pr.1] setting value | Value set with the engineering tool (unit) | Value set with a program (unit) |
|---|---|---|
| 0: mm | 0.1 to 20000000.0 (μm) | 1 to 200000000 ( × $10^{-1}$ μm) |
| 1: inch | 0.00001 to 2000.00000 (inch) | 1 to 200000000 ( × $10^{-5}$ inch) |
| 2: degree | 0.00001 to 2000.00000 (degree) | 1 to 200000000 ( × $10^{-5}$ degree) |
| 3: pulse | 1 to 200000000 (pulse) | 1 to 200000000 (pulse) |

## [Pr.7] Bias speed at start

Set the bias speed (minimum speed) upon starting. When using a stepping motor, etc., set it to start the motor smoothly. (If the motor speed at start is low, the stepping motor does not start smoothly.)

The specified "bias speed at start" will be valid during the following operations:

- Positioning operation
- Home position return operation
- JOG operation

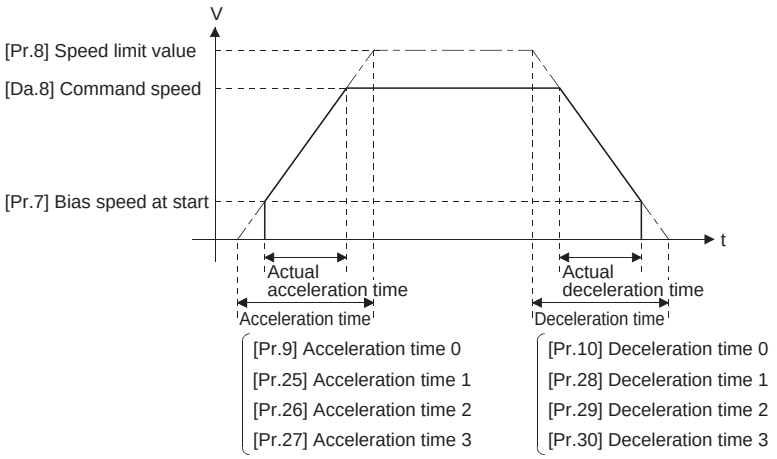
Set the value that the bias speed should not exceed "[Pr.8] Speed limit value".

| [Pr.1] setting value | Value set with the engineering tool (unit) | Value set with a program (unit) |
|---|---|---|
| 0: mm | 0.00 to 20000000.00 (mm/min) | 0 to 2000000000 ( × $10^{-2}$ mm/min) |
| 1: inch | 0.000 to 2000000.000 (inch/min) | 0 to 2000000000 ( × $10^{-3}$ inch/min) |
| 2: degree | 0.000 to 2000000.000 (degree/min)*1 | 0 to 2000000000 ( × $10^{-3}$ degree/min)*2 |
| 3: pulse | 0 to 1000000000 (pulse/s) | 0 to 1000000000 (pulse/s) |

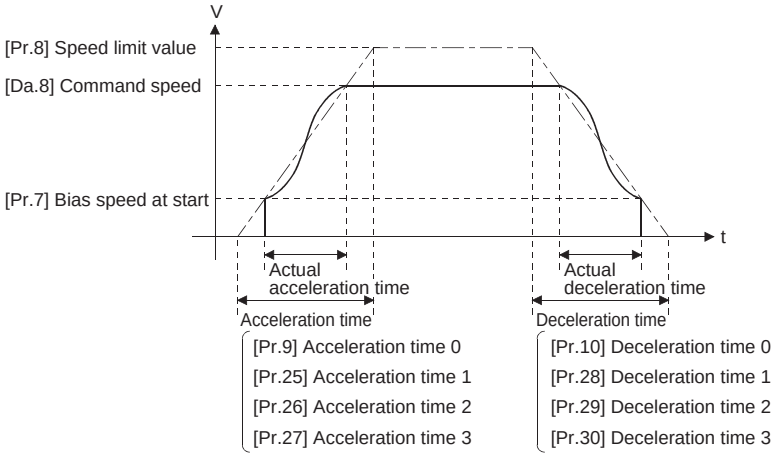
*1 Range of speed limit value when "[Pr.83] Speed control 10 × multiplier setting for degree axis" is set to valid: 0.00 to 20000000.00 (degree/min)

*2 Range of speed limit value when "[Pr.83] Speed control 10 × multiplier setting for degree axis" is set to valid: 0 to 2000000000 ( × $10^{-2}$ degree/min)

Trapezoidal acceleration/deceleration (S-curve ratio is 0%)




S-curve acceleration/deceleration (S-curve ratio is other than 0%)




**Point**

For the 2-axis or more interpolation control, the bias speed at start is applied by the setting of "[Pr.20] Interpolation speed designation method".

- "0: Composite speed": Bias speed at start set to the reference axis is applied to the composite command speed.
- "1: Reference axis speed": Bias speed at start is applied to the reference axis.

## ■Precautionary notes

- "[Pr.7] Bias speed at start" is valid regardless of motor type. Set "0" when using the motor other than the stepping motor. Otherwise, it may cause vibration or impact even though an error does not occur.
- Set "[Pr.7] Bias speed at start" according to the specification of stepping motor driver. If the setting is outside the range, it may cause the following troubles by rapid speed change or overload.
  - Stepping motor steps out.
  - An error occurs in the stepping motor driver.
- In synchronous control, when "[Pr.7] Bias speed at start" is set to the servo input axis, the bias speed at start is applied to the servo input axis. Note that the unexpected operation might be generated to the output axis.
- Set "[Pr.7] Bias speed at start" within the following range.

"[Pr.8] Speed limit value" ≥ "[Pr.46] Home position return speed" ≥ "[Pr.47] Creep speed" ≥ "[Pr.7] Bias speed at start"

- If the data ("[Da.8] Command speed" of positioning data, "[Da.8] Command speed" of next point for continuous path control, or "[Cd.14] New speed value" for speed change function) is less than "[Pr.7] Bias speed at start", the warning "Below bias speed" (warning code: 0908H) will occur and it will operate at "[Pr.7] Bias speed at start".
- When using S-curve acceleration/deceleration processing and bias speed at start together, S-curve acceleration/deceleration processing is carried out based on the acceleration/deceleration time set by user, "[Pr.8] Speed limit value" and "[Pr.35] S-curve ratio" (1 to 100%) in the section of acceleration/deceleration from bias speed at start to command speed.

# Basic parameters2

This section describes the details on the basic parameter 2.

n: Axis No. - 1

| Item | Setting value, setting range | | Default value | Buffer memory address |
|---|---|---|---|---|
| | Value set with the engineering tool | Value set with a program | | |
| [Pr.8]<br>Speed limit value | The setting range differs depending on the "[Pr.1] Unit setting". | | 200000 | 10+150n<br>11+150n |
| [Pr.9]<br>Acceleration time 0 | 1 to 8388608 (ms) | 1 to 8388608 (ms) | 1000 | 12+150n<br>13+150n |
| [Pr.10]<br>Deceleration time 0 | 1 to 8388608 (ms) | 1 to 8388608 (ms) | 1000 | 14+150n<br>15+150n |



## [Pr.8] Speed limit value

Set the maximum speed during positioning, home position return and speed-torque operations.

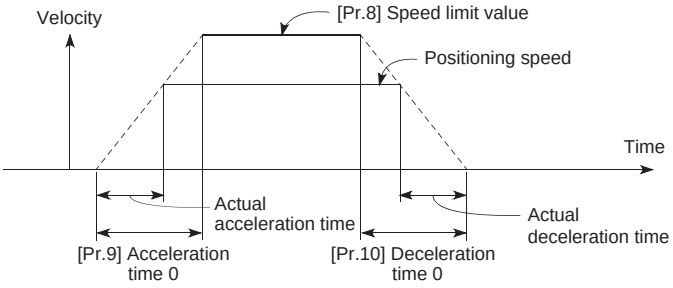
| [Pr.1] setting value | Value set with the engineering tool (unit) | Value set with a program (unit) |
|---|---|---|
| 0: mm | 0.01 to 20000000.00 (mm/min) | 1 to 2000000000 ( $\times 10^{-2}$ mm/min) |
| 1: inch | 0.001 to 2000000.000 (inch/min) | 1 to 2000000000 ( $\times 10^{-3}$ inch/min) |
| 2: degree | 0.001 to 2000000.000 (degree/min)*1 | 1 to 2000000000 ( $\times 10^{-3}$ degree/min)*2 |
| 3: pulse | 1 to 1000000000 (pulse/s) | 1 to 1000000000 (pulse/s) |

*1 Range of speed limit value when "[Pr.83] Speed control 10 × multiplier setting for degree axis" is set to valid: 0.01 to 20000000.00 (degree/min).

*2 Range of speed limit value when "[Pr.83] Speed control 10 × multiplier setting for degree axis" is set to valid: 1 to 2000000000 ( $\times 10^{-2}$ degree/min)

## [Pr.9] Acceleration time 0, [Pr.10] Deceleration time 0

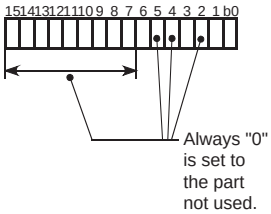
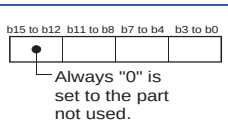
"[Pr.9] Acceleration time 0" specifies the time for the speed to increase from zero to the "[Pr.8] Speed limit value" ("[Pr.31] JOG speed limit value" at JOG operation control). "[Pr.10] Deceleration time 0" specifies the time for the speed to decrease from the "[Pr.8] Speed limit value" ("[Pr.31] JOG speed limit value" at JOG operation control) to zero.




- If the positioning speed is set lower than the parameter-defined speed limit value, the actual acceleration/deceleration time will be relatively short. Thus, set the maximum positioning speed equal to or only a little lower than the parameter-defined speed limit value.
- These settings are valid for home position return, positioning and JOG operations.
- When the positioning involves interpolation, the acceleration/deceleration time defined for the reference axis is valid.

# Detailed parameters1

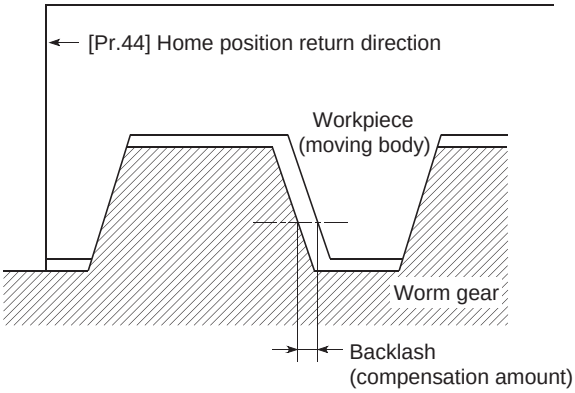
n: Axis No. - 1

| Item | Setting value, setting range | | | Default value | Buffer memory address |
|---|---|---|---|---|---|
| | Value set with the engineering tool | | Value set with a program | | |
| [Pr.11] Backlash compensation amount | The setting value range differs according to the "[Pr.1] Unit setting". | | | 0 | 17+150n |
| [Pr.12] Software stroke limit upper limit value | | | | 2147483647 | 18+150n<br>19+150n |
| [Pr.13] Software stroke limit lower limit value | | | | -2147483648 | 20+150n<br>21+150n |
| [Pr.14] Software stroke limit selection | 0: Apply software stroke limit on current feed value | | 0 | 0 | 22+150n |
| | 1: Apply software stroke limit on machine feed value | | 1 | | |
| [Pr.15] Software stroke limit valid/invalid setting | 0: Software stroke limit valid during JOG operation, inching operation and manual pulse generator operation | | 0 | 0 | 23+150n |
| | 1: Software stroke limit invalid during JOG operation, inching operation and manual pulse generator operation | | 1 | | |
| [Pr.16] Command in-position width | The setting value range differs depending on the "[Pr.1] Unit setting". | | | 100 | 24+150n<br>25+150n |
| [Pr.17] Torque limit setting value | 0.1 to 1000.0 (%) | | 1 to 10000 (× 0.1%) | 3000 | 26+150n |
| [Pr.18] M code ON signal output timing | 0: WITH mode | | 0 | 0 | 27+150n |
| | 1: AFTER mode | | 1 | | |
| [Pr.19] Speed switching mode | 0: Standard speed switching mode | | 0 | 0 | 28+150n |
| | 1: Front-loading speed switching mode | | 1 | | |
| [Pr.20] Interpolation speed designation method | 0: Composite speed | | 0 | 0 | 29+150n |
| | 1: Reference axis speed | | 1 | | |
| [Pr.21] Current feed value during speed control | 0: Do not update current feed value | | 0 | 0 | 30+150n |
| | 1: Update current feed value | | 1 | | |
| | 2: Clear current feed value to zero | | 2 | | |
| [Pr.22] Input signal logic selection | b0 | Lower limit | 0: Negative logic<br>1: Positive logic |  | 0 | 31+150n |
| | b1 | Upper limit | | | | |
| | b2 | Not used | | | | |
| | b3 | Stop signal | | | | |
| | b4 | Not used | | | | |
| | b5 | Not used | | | | |
| | b6 | Near-point dog signal | | | | |
| | b7 to b15 | Not used | | | | |
| [Pr.81] Speed-position function selection | 0: Speed-position switching control (INC mode) | | | 0 | 34+150n |
| | 2: Speed-position switching control (ABS mode) | | | 2 | |
| [Pr.116] FLS signal selection | b0 to b3: Input type<br>0 (0000H): Simple Motion module<br>1 (0001H): Servo amplifier*1<br>2 (0002H): Buffer memory<br>15 (000FH): Invalid<br>b4 to b11: Input terminal<br>RD77MS: 01H to 0AH<br>RD77MS4/8/16: 01H to 14H<br>b12 to b15: Not used | | |  | 0001H | 116+150n |
| [Pr.117] RLS signal selection | | | | | 0001H | 117+150n |
| [Pr.118] DOG signal selection | | | | | 0001H | 118+150n |
| [Pr.119] STOP signal selection | | | | | 0002H | 119+150n |

*1 The setting is not available in "[Pr.119] STOP signal selection".

## [Pr.11] Backlash compensation amount

The error that occurs due to backlash when moving the machine via gears can be compensated.
(When the backlash compensation amount is set, commands equivalent to the compensation amount will be output each time the direction changes during positioning.)




- The backlash compensation is valid after machine home position return. Thus, if the backlash compensation amount is set or changed, always carry out machine home position return once.
- "[Pr.2] Number of pulses per rotation", "[Pr.3] Movement amount per rotation", "[Pr.4] Unit magnification" and "[Pr.11] Backlash compensation amount" which satisfies the following (1) can be set up.

$$0 \leq \frac{\text{([Pr.11] Backlash compensation amount)} \times \text{([Pr.2] Number of pulses per rotation)}}{\text{([Pr.3] Movement amount per rotation)} \times \text{([Pr.4] Unit magnification)}} \text{ (= A)} \leq 4194303 \text{ (pulse): (1)}$$

(round down after decimal point)

The error "Backlash compensation amount error" (error code: 1AA0H) occurs when the setting is outside the range of the calculation result of (1).
A servo alarm (error code: 2031, 2035, etc.) may occur by kinds of servo amplifier (servomotor), load inertia moment and the amount of command of a cycle time (Simple Motion module) even if the setting is within the calculation result of (1).
Reduce the setting value of "[Pr.11] Backlash compensation amount" or increase the operation cycle by "[Pr.96] Operation cycle setting" if a servo alarm occurs. Use the value of the following (2) as a measure that a servo alarm does not occur.

$$A \leq \frac{\text{(Maximum motor speed (r/min))} \times 1.2 \times \text{(Encoder resolution (pulse/rev))} \times \text{(Operation cycle (ms))}}{60 \text{ (s)} \times 1000 \text{ (ms)}} \text{ (pulse): (2)}$$

| [Pr.1] setting value | Value set with the engineering tool (unit) | Value set with a program (unit)*1 |
|---|---|---|
| 0: mm | 0 to 6553.5 (μm) | 0 to 65535 ( × $10^{-1}$ μm) |
| 1: inch | 0 to 0.65535 (inch) | 0 to 65535 ( × $10^{-5}$ inch) |
| 2: degree | 0 to 0.65535 (degree) | 0 to 65535 ( × $10^{-5}$ degree) |
| 3: pulse | 0 to 65535 (pulse) | 0 to 65535 (pulse) |

*1 0 to 32767: Set as a decimal
32768 to 65535: Convert into hexadecimal and set

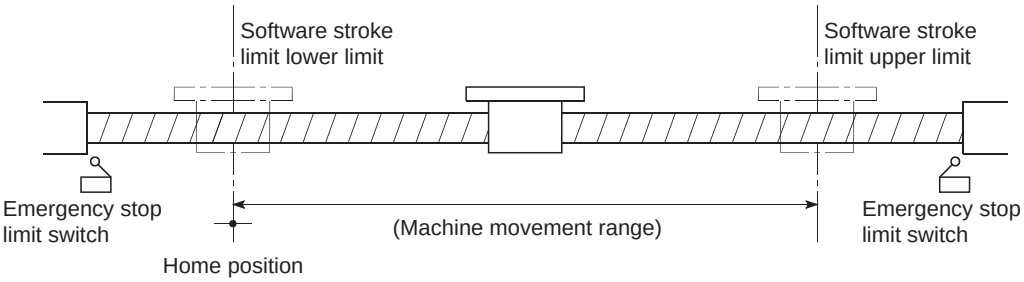
## [Pr.12] Software stroke limit upper limit value

Set the upper limit for the machine's movement range during positioning control.

| [Pr.1] setting value | Value set with the engineering tool (unit) | Value set with a program (unit) |
|---|---|---|
| 0: mm | -214748364.8 to 214748364.7 (μm) | -2147483648 to 2147483647 ( × $10^{-1}$ μm) |
| 1: inch | -21474.83648 to 21474.83647 (inch) | -2147483648 to 2147483647 ( × $10^{-5}$ inch) |
| 2: degree | 0 to 359.99999 (degree) | 0 to 35999999 ( × $10^{-5}$ degree) |
| 3: pulse | -2147483648 to 2147483647 (pulse) | -2147483648 to 2147483647 (pulse) |

## [Pr.13] Software stroke limit lower limit value

Set the lower limit for the machine's movement range during positioning control.




- Generally, the home position is set at the lower limit or upper limit of the stroke limit.
- By setting the upper limit value or lower limit value of the software stroke limit, overrun can be prevented in the software. However, an emergency stop limit switch must be installed nearby outside the range. To invalidate the software stroke limit, set the setting value to "upper limit value = lower limit value". (If it is within the setting range, the setting value can be anything.) When the unit is "degree", the software stroke limit check is invalid during speed control (including the speed control in speed-position and position-speed switching control) or during manual control.

## [Pr.14] Software stroke limit selection

Set whether to apply the software stroke limit on the "current feed value" or the "machine feed value". The software stroke limit will be validated according to the set value. To invalidate the software stroke limit, set the setting value to "current feed value".

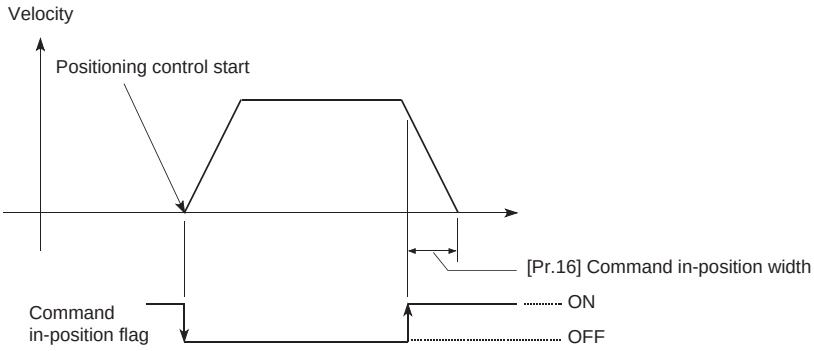
When "2: degree" is set in "[Pr.1] Unit setting", set the setting value of software stroke limit to "current feed value". The error "Software stroke limit selection" (error code: 1AA5H) will occur if "machine feed value" is set.

## [Pr.15] Software stroke limit valid/invalid setting

Set whether to validate the software stroke limit during JOG/Inching operation and manual pulse generator operation.

## [Pr.16] Command in-position width

Set the remaining distance that turns the command in-position ON. The command in-position signal is used as a front-loading signal of the positioning complete signal. When positioning control is started, the "Command in-position flag ([Md.31] Status: b2)" turns OFF, and the "command in-position flag" turns ON at the set position of the command in-position signal.




| [Pr.1] setting value | Value set with the engineering tool (unit) | Value set with a program (unit) |
|---|---|---|
| 0: mm | 0.1 to 214748364.7 (μm) | 1 to 2147483647 ( $\times 10^{-1}$ μm) |
| 1: inch | 0.00001 to 21474.83647 (inch) | 1 to 2147483647 ( $\times 10^{-5}$ inch) |
| 2: degree | 0.00001 to 21474.83647 (degree) | 1 to 2147483647 ( $\times 10^{-5}$ degree) |
| 3: pulse | 1 to 2147483647 (pulse) | 1 to 2147483647 (pulse) |

## [Pr.17] Torque limit setting value

Set the maximum value of the torque generated by the servomotor as a percentage between 0.1 and 1000.0%.

*1 The torque limit function limits the torque generated by the servomotor within the set range.
If the torque required for control exceeds the torque limit value, it is controlled with the set torque limit value.
☞ Page 235 Torque limit function

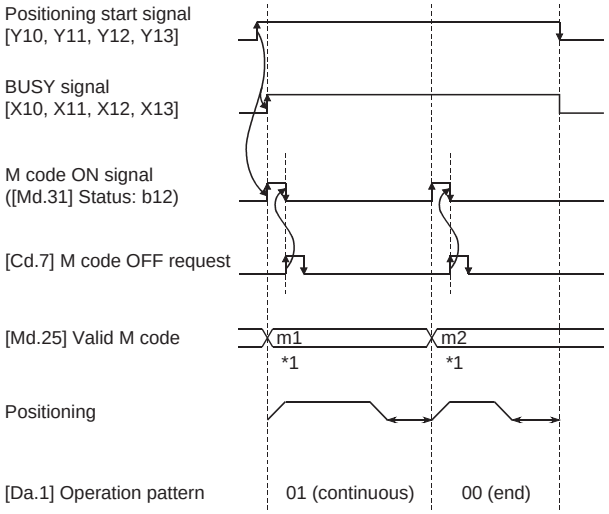
## [Pr.18] M code ON signal output timing

This parameter sets the M code ON signal output timing.

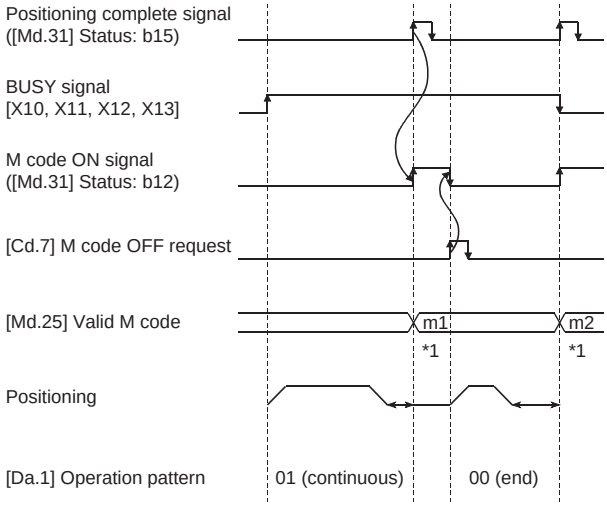
Choose either WITH mode or AFTER mode as the M code ON signal output timing.

### ■RD77MS4 operation example

WITH mode: An M code is output and the M code ON signal is turned ON when a positioning operation starts.




AFTER mode: An M code is output and the M code ON signal is turned ON when a positioning operation completes.




*1 m1 and m2 indicate set M codes.

*2 If AFTER mode is used with speed control, an M code will not be output and the M code ON signal will not be turned ON.

An M code is a number between 0 and 65535 that can be assigned to each positioning data ([Da.10]).

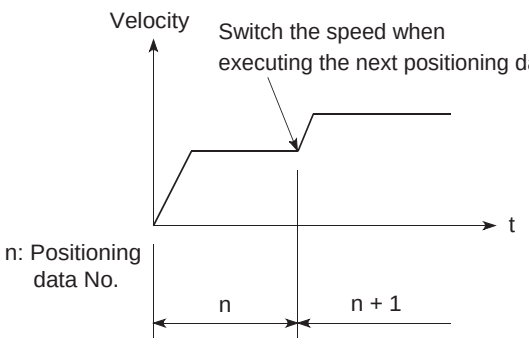
The program can be coded to read an M code from the buffer memory address specified by "[Md.25] Valid M code" whenever the M code ON signal turns ON so that a command for the sub work (e.g. clamping, drilling, or tool change) associated with the M code can be issued.

*1 The M code ON signal output timing can be set to each positioning data using the positioning option of the positioning data ([Da.27]).

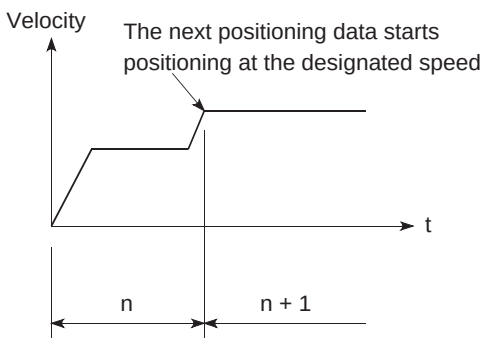
## [Pr.19] Speed switching mode

Set whether to switch the speed switching mode with the standard switching or front-loading switching mode.

| Setting value | Details |
|---|---|
| 0: Standard switching | Switch the speed when executing the next positioning data. |
| 1: Front-loading switching | The speed switches at the end of the positioning data currently being executed. |




<For standard switching>

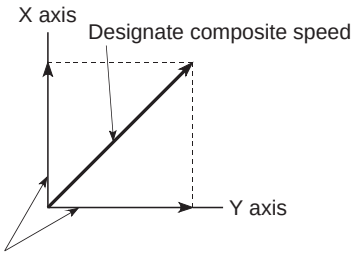



<For front-loading switching>

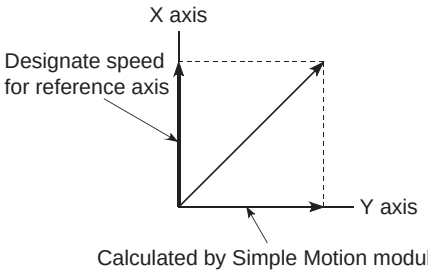
## [Pr.20] Interpolation speed designation method

When carrying out linear interpolation/circular interpolation, set whether to designate the composite speed or reference axis speed.

| Setting value | Details |
|---|---|
| 0: Composite speed | The movement speed for the control target is designated, and the speed for each axis is calculated by the Simple Motion module. |
| 1: Reference axis speed | The axis speed set for the reference axis is designated, and the speed for the other axis carrying out interpolation is calculated by the Simple Motion module. |




<When composite speed is designated>




<When reference axis speed is designated>

**Point**

When the 4-axis linear interpolation or 2 to 4-axis speed control is performed, specify the reference axis speed.

If the composite speed is specified, the error "Interpolation mode error" (error code: 199AH) occurs when the positioning operation starts.

When the circular interpolation control or 3-axis helical interpolation control is performed, specify the composite speed. If the reference axis speed is specified, the error "Interpolation mode error" (error code: 199BH) occurs when the positioning operation starts.

## [Pr.21] Current feed value during speed control

Specify whether you wish to enable or disable the update of "[Md.20] Current feed value" while operations are performed under the speed control (including the speed control in speed-position and position-speed switching control).

| Setting value | Details |
|---|---|
| 0: The update of the current feed value is disabled | The current feed value will not change. (The value at the beginning of the speed control will be kept.) |
| 1: The update of the current feed value is enabled | The current feed value will be updated. (The current feed value will change from the initial.) |
| 2: The current feed value is cleared to zero | The current feed value will be set initially to zero and change from zero while the speed control is in effect. |

**Point**

- When the speed control is performed over two to four axes, the choice between enabling and disabling the update of "[Md.20] Current feed value" depends on how the reference axis is set.
- Set "1" to exercise speed-position switching control (ABS mode).

## [Pr.22] Input signal logic selection

Set the input signal logic that matches the signaling specification of the external input signal (upper/lower limit switch, near-point dog) of servo amplifier connected to the Simple Motion module or "[Cd.44] External input signal operation device (Axis 1 to 16)".

### ■Negative logic

- The current is not flowed through the input signal contact.

  - FLS, RLS: Limit signal ON
  - DOG, DI, STOP: Invalid

- The current is flowed through the input signal contact.

  - FLS, RLS: Limit signal OFF
  - DOG, DI, STOP: Valid

### ■Positive logic

Opposite the concept of negative logic.

**Point**

A mismatch in the signal logic will disable normal operation. Be careful of this when you change from the default value.

## [Pr.81] Speed-position function selection

Select the mode of speed-position switching control.

0: INC mode

2: ABS mode

**Point**

If the setting is other than 0 and 2, operation is performed in the INC mode with the setting regarded as 0.

## [Pr.116] to [Pr.119] FLS/RLS/DOG/STOP signal selection

### ■Input type

Set the input type whose external input signal (upper/lower limit signal (FLS/RLS), near-point dog signal (DOG) or stop signal (STOP)) is used.

0 (0000H): Simple Motion module (Uses the external input signal of the Simple Motion module.)

1 (0001H): Servo amplifier[*1*2] (Uses the external input signal of the servo amplifier.)

2 (0002H): Buffer memory (Uses the buffer memory of the Simple Motion module.)

15 (000FH): Invalid (Does not use the external input signal.)

*1 The setting is not available in "[Pr.119] STOP signal selection". If it is set, the error "STOP signal selection error" (error code: 1AD3H) occurs and the PLC READY signal [Y0] is not turned ON.

*2 When it is set in "[Pr.116] FLS signal selection" to "[Pr.118] DOG signal selection" at MR-JE-B use, any errors or warnings do not occur. However, the external input signal (upper/lower limit signal, near-point dog signal) cannot be operated.

### ■Input terminal

When the input type is set with "0: Simple Motion module", set the input terminal. The setting is not required when the value other than "0" is set.

00H: No setting (The control by the external input signal is disabled.)

• [RD77MS2]

01H to 0AH: Set the input terminal.

• [RD77MS4/RD77MS8/RD77MS16]

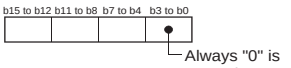
01H to 14H: Set the input terminal.

| Setting value | Pin No. | Input terminal | Setting value | Pin No. | Input terminal |
|---|---|---|---|---|---|
| 01H | 1A1 | SIN1 | 0BH | 2A1 | SIN11 |
| 02H | 1A2 | SIN2 | 0CH | 2A2 | SIN12 |
| 03H | 1A3 | SIN3 | 0DH | 2A3 | SIN13 |
| 04H | 1A4 | SIN4 | 0EH | 2A4 | SIN14 |
| 05H | 1A5 | SIN5 | 0FH | 2A5 | SIN15 |
| 06H | 1B1 | SIN6 | 10H | 2B1 | SIN16 |
| 07H | 1B2 | SIN7 | 11H | 2B2 | SIN17 |
| 08H | 1B3 | SIN8 | 12H | 2B3 | SIN18 |
| 09H | 1B4 | SIN9 | 13H | 2B4 | SIN19 |
| 0AH | 1B5 | SIN10 | 14H | 2B5 | SIN20 |

# Detailed parameters2

n: Axis No. - 1

| Item | Setting value, setting range | | Default value | Buffer memory address |
|---|---|---|---|---|
| | Value set with the engineering tool | Value set with a program | | |
| [Pr.25] Acceleration time 1 | 1 to 8388608 (ms) | 1 to 8388608 (ms) | 1000 | 36+150n<br>37+150n |
| [Pr.26] Acceleration time 2 | | | | 38+150n<br>39+150n |
| [Pr.27] Acceleration time 3 | | | | 40+150n<br>41+150n |
| [Pr.28] Deceleration time 1 | | | | 42+150n<br>43+150n |
| [Pr.29] Deceleration time 2 | | | | 44+150n<br>45+150n |
| [Pr.30] Deceleration time 3 | | | | 46+150n<br>47+150n |
| [Pr.31] JOG speed limit value | The setting range differs depending on the "[Pr.1] Unit setting". | | 20000 | 48+150n<br>49+150n |
| [Pr.32] JOG operation acceleration time selection | 0: [Pr.9] Acceleration time 0 | 0 | 0 | 50+150n |
| | 1: [Pr.25] Acceleration time 1 | 1 | | |
| | 2: [Pr.26] Acceleration time 2 | 2 | | |
| | 3: [Pr.27] Acceleration time 3 | 3 | | |
| [Pr.33] JOG operation deceleration time selection | 0: [Pr.10] Deceleration time 0 | 0 | 0 | 51+150n |
| | 1: [Pr.28] Deceleration time 1 | 1 | | |
| | 2: [Pr.29] Deceleration time 2 | 2 | | |
| | 3: [Pr.30] Deceleration time 3 | 3 | | |
| [Pr.34] Acceleration/deceleration process selection | 0: Trapezoid acceleration/deceleration process | 0 | 0 | 52+150n |
| | 1: S-curve acceleration/deceleration process | 1 | | |
| [Pr.35] S-curve ratio | 1 to 100 (%) | 1 to 100 (%) | 100 | 53+150n |
| [Pr.36] Sudden stop deceleration time | 1 to 8388608 (ms) | 1 to 8388608 (ms) | 1000 | 54+150n<br>55+150n |
| [Pr.37] Stop group 1 sudden stop selection | 0: Normal deceleration stop | 0 | 0 | 56+150n |
| | 1: Sudden stop | 1 | | |
| [Pr.38] Stop group 2 sudden stop selection | 0: Normal deceleration stop | 0 | | 57+150n |
| | 1: Sudden stop | 1 | | |
| [Pr.39] Stop group 3 sudden stop selection | 0: Normal deceleration stop | 0 | | 58+150n |
| | 1: Sudden stop | 1 | | |
| [Pr.40] Positioning complete signal output time | 0 to 65535 (ms) | 0 to 65535 (ms)<br>0 to 32767: Set as a decimal<br>32768 to 65535: Convert into hexadecimal and set | 300 | 59+150n |
| [Pr.41] Allowable circular interpolation error width | The setting value range differs depending on the "[Pr.1] Unit setting". | | 100 | 60+150n<br>61+150n |
| [Pr.42] External command function selection | 0: External positioning start | 0 | 0 | 62+150n |
| | 1: External speed change request | 1 | | |
| | 2: Speed-position, position-speed switching request | 2 | | |
| | 3: Skip request | 3 | | |
| | 4: High speed input request | 4 | | |

| Item | Setting value, setting range | | | Default value | Buffer memory address |
|---|---|---|---|---|---|
| | Value set with the engineering tool | | Value set with a program | | |
| [Pr.83] Speed control 10 times multiplier setting for degree axis | 0: Invalid | | 0 | 0 | 63+150n |
| | 1: Valid | | 1 | | |
| [Pr.84] Restart allowable range when servo OFF to ON | 0, 1 to 327680 [pulse]<br>0: restart not allowed | | | 0 | 64+150n<br>65+150n |
| [Pr.90] Operation setting for speed-torque control mode | b0 to b3 | Not used |  <br>Always "0" is set to the part not used. | 0000H | 68+150n |
| | b4 to b7 | Torque initial value selection<br>0: Command torque<br>1: Feedback torque | | | |
| | b8 to b11 | Speed initial value selection<br>0: Command speed<br>1: Feedback speed<br>2: Automatic selection | | | |
| | b12 to b15 | Condition selection at mode switching<br>0: Switching conditions valid (for switching control mode)<br>1: Zero speed ON condition invalid (for switching control mode) | | | |
| [Pr.95] External command signal selection | 0: Not used | | 0 | 0 | 69+150n |
| | 1 to 20: DI1 to DI20 | | 1 to 20 | | |
| [Pr.122] Manual pulse generator speed limit mode | 0: Don't hold speed limit<br>1: Don't output over value of speed limit<br>2: Output over value of speed limit later | | 0<br>1<br>2 | 0 | 121+150n |
| [Pr.123] Manual pulse generator speed limit value | The setting value range differs depending on the "[Pr.1] Unit setting". | | | 20000 | 122+150n<br>123+150n |

## [Pr.25] Acceleration time 1 to [Pr.27] Acceleration time 3

These parameters set the time for the speed to increase from zero to the "[Pr.8] Speed limit value" ("[Pr.31] JOG speed limit value" at JOG operation control) during a positioning operation.

## [Pr.28] Deceleration time 1 to [Pr.30] Deceleration time 3

These parameters set the time for the speed to decrease from the "[Pr.8] Speed limit value" ("[Pr.31] JOG speed limit value" at JOG operation control) to zero during a positioning operation.

## [Pr.31] JOG speed limit value

Set the maximum speed for JOG operation.

| [Pr.1] setting value | Value set with the engineering tool (unit) | Value set with a program (unit) |
|---|---|---|
| 0: mm | 0.01 to 20000000.00 (mm/min) | 1 to 2000000000 ( $\times 10^{-2}$ mm/min) |
| 1: inch | 0.001 to 2000000.000 (inch/min) | 1 to 2000000000 ( $\times 10^{-3}$ inch/min) |
| 2: degree | 0.001 to 2000000.000 (degree/min)*1 | 1 to 2000000000 ( $\times 10^{-3}$ degree/min)*2 |
| 3: pulse | 1 to 1000000000 (pulse/s) | 1 to 1000000000 (pulse/s) |

*1 The range of JOG speed limit value when "[Pr.83] Speed control 10 × multiplier setting for degree axis" is valid: 0.01 to 20000000.00 (degree/min)

*2 The range of JOG speed limit value when "[Pr.83] Speed control 10 × multiplier setting for degree axis" is valid: 1 to 2000000000 ($\times 10^{-2}$ degree/min)

**Point**

Set the "JOG speed limit value" to a value less than "[Pr.8] Speed limit value". If the "speed limit value" is exceeded, the error "JOG speed limit value error" (error code: 1AB7H) will occur.

## [Pr.32] JOG operation acceleration time selection

Set which of "acceleration time 0 to 3" to use for the acceleration time during JOG operation.

0: Use value set in "[Pr.9] Acceleration time 0".

1: Use value set in "[Pr.25] Acceleration time 1".

2: Use value set in "[Pr.26] Acceleration time 2".

3: Use value set in "[Pr.27] Acceleration time 3".

## [Pr.33] JOG operation deceleration time selection

Set which of "deceleration time 0 to 3" to use for the deceleration time during JOG operation.

0: Use value set in "[Pr.10] Deceleration time 0".

1: Use value set in "[Pr.28] Deceleration time 1".

2: Use value set in "[Pr.29] Deceleration time 2".

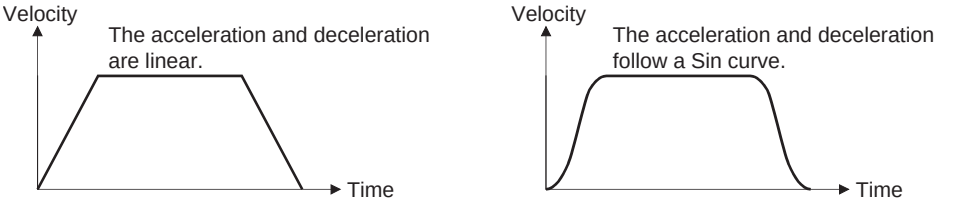
3: Use value set in "[Pr.30] Deceleration time 3".

## [Pr.34] Acceleration/deceleration process selection

Set whether to use trapezoid acceleration/deceleration or S-curve acceleration/deceleration for the acceleration/deceleration process.

*1 Refer to the following for details.

☞ Page 292 Acceleration/deceleration processing function

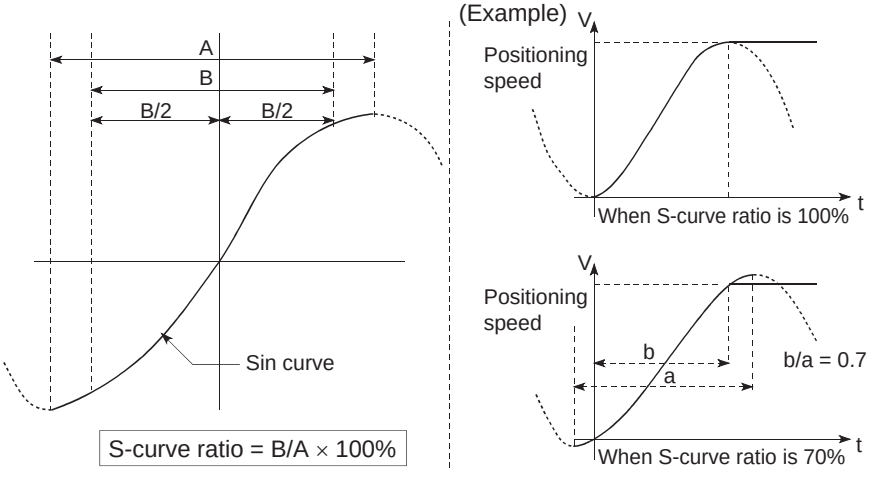



<Trapezoid acceleration/deceleration> <S-curve acceleration/deceleration>

## [Pr.35] S-curve ratio

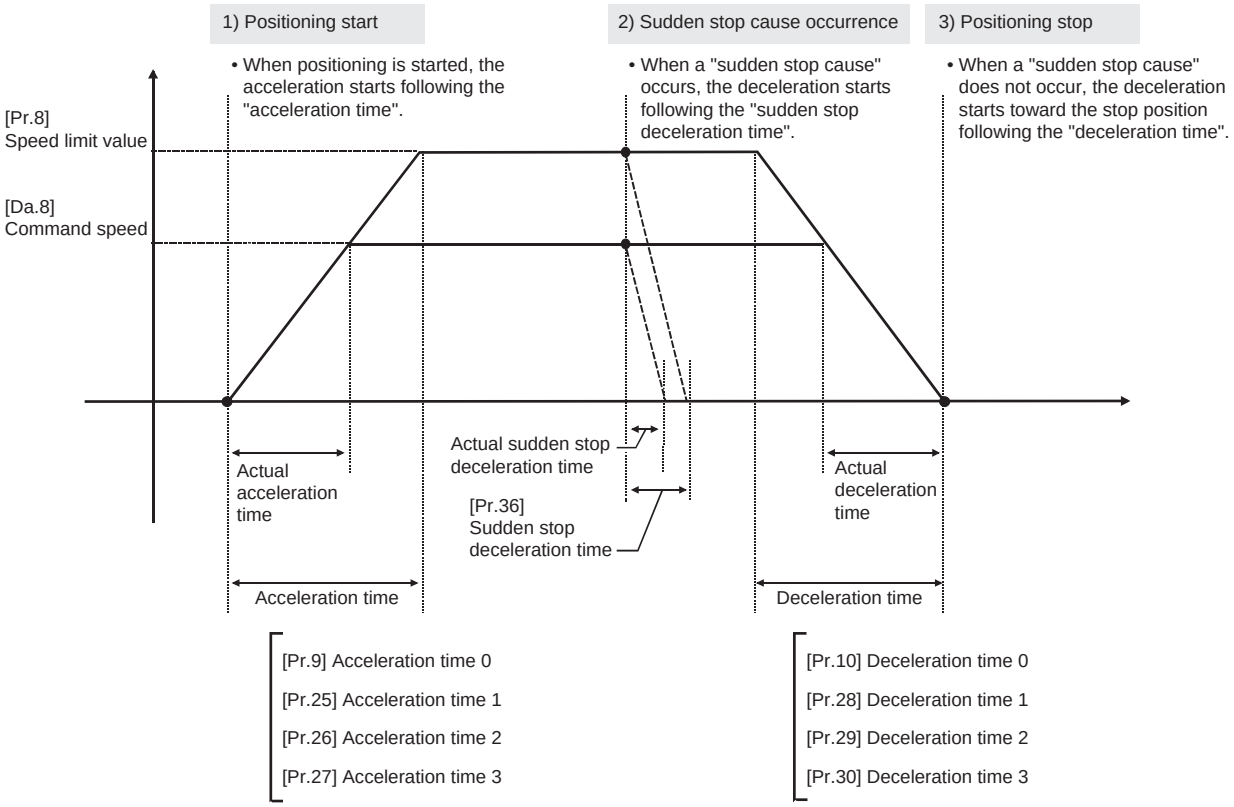
Set the S-curve ratio (1 to 100%) for carrying out the S-curve acceleration/deceleration process.

The S-curve ratio indicates where to draw the acceleration/deceleration curve using the Sin curve as shown below.



## [Pr.36] Sudden stop deceleration time

Set the time to reach speed 0 from "[Pr.8] Speed limit value" ("[Pr.31] JOG speed limit value" at JOG operation control) during the sudden stop. The illustration below shows the relationships with other parameters.


1) Positioning start
2) Sudden stop cause occurrence
3) Positioning stop
• When positioning is started, the acceleration starts following the "acceleration time".
• When a "sudden stop cause" occurs, the deceleration starts following the "sudden stop deceleration time".
• When a "sudden stop cause" does not occur, the deceleration starts toward the stop position following the "deceleration time".
[Pr.8] Speed limit value
[Da.8] Command speed
Actual acceleration time
Actual sudden stop deceleration time
[Pr.36] Sudden stop deceleration time
Actual deceleration time
Acceleration time
Deceleration time
[Pr.9] Acceleration time 0
[Pr.25] Acceleration time 1
[Pr.26] Acceleration time 2
[Pr.27] Acceleration time 3
[Pr.10] Deceleration time 0
[Pr.28] Deceleration time 1
[Pr.29] Deceleration time 2
[Pr.30] Deceleration time 3

## [Pr.37] to [Pr.39] Stop group 1/2/3 sudden stop selection

Set the method to stop when the stop causes in the following stop groups occur.

| Stop group | Details |
|---|---|
| Stop group 1 | Stop with hardware stroke limit |
| Stop group 2 | Error occurrence of the CPU module, PLC READY signal [Y0] OFF, Fault in test mode |
| Stop group 3 | Axis stop signal from the CPU module, Stop signal from the engineering tool, Error occurrence (excludes errors in stop groups 1 and 2: includes only the software stroke limit errors during JOG operation, speed control, speed-position switching control, and position-speed switching control) |

The methods of stopping include "0: Normal deceleration stop" and "1: Sudden stop".

If "1: Sudden stop" is selected, the axis will suddenly decelerate to a stop when the stop cause occurs.

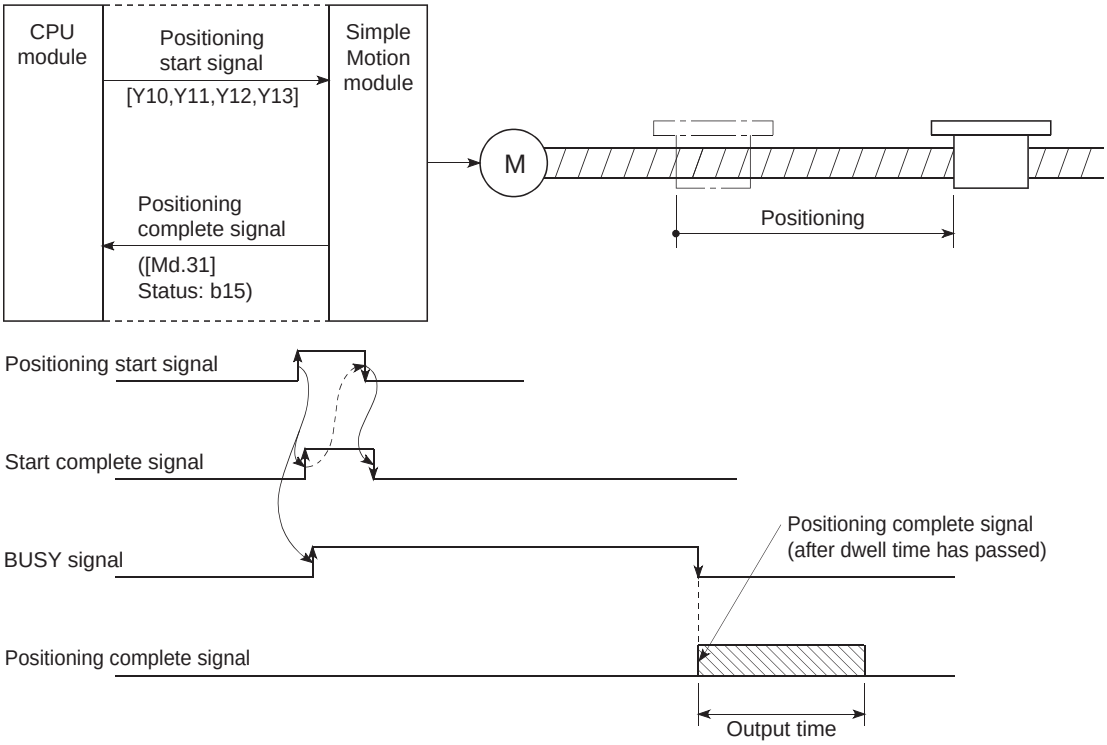
## [Pr.40] Positioning complete signal output time

Set the output time of the positioning complete signal output from the Simple Motion module.

A positioning completes when the specified dwell time has passed after the Simple Motion module had terminated the command output.

For the interpolation control, the positioning completed signal of interpolation axis is output only during the time set to the reference axis.

### ■RD77MS4 operation example



## [Pr.41] Allowable circular interpolation error width

The allowable error range of the calculated arc path and end point address is set.*1

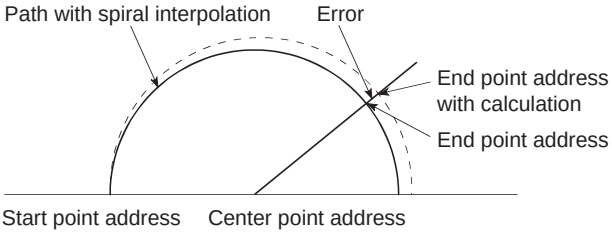
If the error of the calculated arc path and end point address is within the set range, circular interpolation will be carried out to the set end point address while compensating the error with spiral interpolation.

The allowable circular interpolation error width is set in the following axis buffer memory addresses.

Ex.

· If axis 1 is the reference axis, set in the axis 1 buffer memory addresses [60, 61].

· If axis 4 is the reference axis, set in the axis 4 buffer memory addresses [510, 511].




*1 With circular interpolation control using the center point designation, the arc path calculated with the start point address and center point address and the end point address may deviate.

| [Pr.1] setting value | Value set with the engineering tool (unit) | Value set with a program (unit) |
|---|---|---|
| 0: mm | 0 to 10000.0 (μm) | 0 to 100000 ( × $10^{-1}$ μm) |
| 1: inch | 0 to 1.00000 (inch) | 0 to 100000 ( × $10^{-5}$ inch) |
| 2: degree | 0 to 1.00000 (degree) | 0 to 100000 ( × $10^{-5}$ degree) |
| 3: pulse | 0 to 100000 (pulse) | 0 to 100000 (pulse) |

## [Pr.42] External command function selection

Select a command with which the external command signal should be associated.

| Setting value | Details |
|---|---|
| 0: External positioning start | The external command signal input is used to start a positioning operation. |
| 1: External speed change request | The external command signal input is used to change the speed in the current positioning operation.<br>The new speed should be set in the "[Cd.14] New speed value". |
| 2: Speed-position, position-speed switching request | The external command signal input is used to switch from the speed control to the position control while in the speed-position switching control mode, or from the position control to the speed control while in the position-speed switching control mode.<br>To enable the speed-position switching control, set the "[Cd.24] Speed-position switching enable flag" to "1". To enable the position-speed switching control, set the "[Cd.26] Position-speed switching enable flag" to "1". |
| 3: Skip request | The external command signal input is used skip the current positioning operation. |
| 4: High speed input request | The external command signal input is used to execute the mark detection. And, also set to use the external command signal in the synchronous control. |

**Point**

To enable the external command signal, set the "[Cd.8] External command valid" to "1".

## [Pr.83] Speed control 10 times multiplier setting for degree axis

Set the speed control 10 × multiplier setting for degree axis when you use command speed and speed limit value set by the positioning data and the parameter at "[Pr.1] Unit setting" setup degree by ten times at the speed.

0: Invalid

1: Valid

Normally, the speed specification range is 0.001 to 2000000.000 [degree/min], but it will be decupled and become 0.01 to 20000000.00 [degree/min] by setting "[Pr.83] Speed control 10 × multiplier setting for degree axis"*1 to valid.

*1 The "Speed control 10 × multiplier setting for degree axis" is included in detailed parameters 2. However, it will be valid at the leading edge (OFF to ON) of the PLC READY signal [Y0].

*2 Refer to the following for details on the speed control 10 × multiplier setting for degree axis.

☞ Page 297 Speed control 10 times multiplier setting for degree axis function

| [Pr.83] setting value | Value set with the engineering tool (unit) | Value set with a program (unit) |
|---|---|---|
| 0: Invalid | 0.001 to 2000000.000 (degree/min) | 1 to 2000000000 ( × $10^{-3}$ degree/min) |
| 1: Valid | 0.01 to 20000000.00 (degree/min) | 1 to 2000000000 ( × $10^{-2}$ degree/min) |

## [Pr.84] Restart allowable range when servo OFF to ON

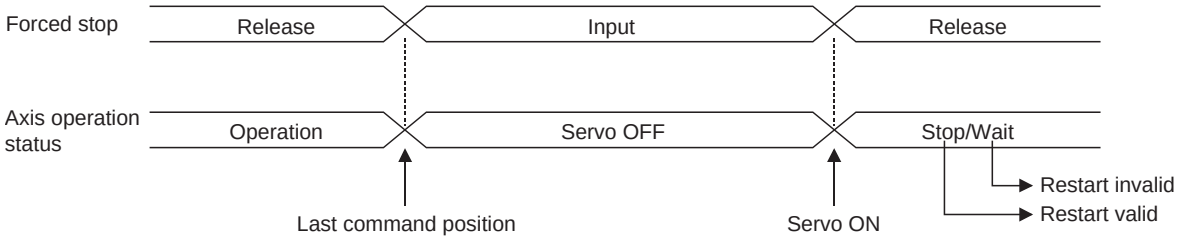
### ■Restart function at switching servo OFF to ON

The restart function at switching servo OFF to ON performs continuous positioning operation (positioning start, restart) when switching servo OFF to ON while the Simple Motion module is stopped (including forced stop, servo forced stop).

Restart at switching servo OFF to ON can be performed when the difference between the last command position of Simple Motion module at stop and the present value at switching servo OFF to ON is equal to or less than the value set in the buffer memory for the restart allowable range setting.

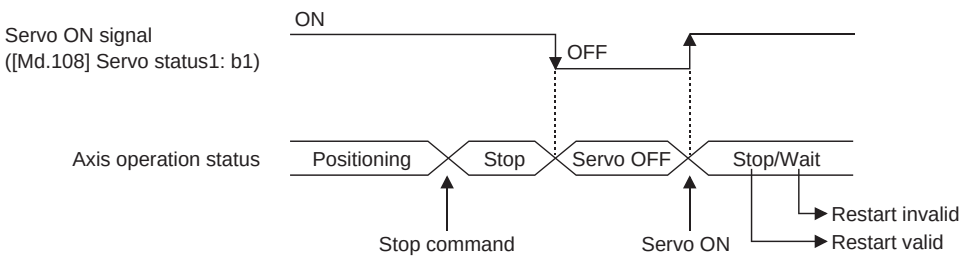
- Servo emergency stop processing

- When the difference between the last command position of Simple Motion module at the forced stop input or the servo forced stop input and the present value at the forced stop release or the servo forced stop release is equal to or less than the value set in the buffer memory for the restart allowable range setting, the positioning operation is judged as stopped and can be restarted.
- When the difference between the last command position of Simple Motion module at the forced stop input or the servo forced stop input and the present value at the forced stop release or the servo forced stop release is greater than the value set in the buffer memory for the restart allowable range setting, the positioning operation is judged as on-standby and cannot be restarted.




- Processing at switching the servo ON signal from OFF to ON

- When the difference between the last command position of Simple Motion module at switching the servo ON signal from ON to OFF and the present value at switching the servo ON signal from OFF to ON is equal to or less than the value set in the buffer memory for the restart allowable range setting, the positioning operation is judged as stopped and can be restarted.
- When the difference between the last command position of Simple Motion module at switching the servo ON signal from ON to OFF and the present value at switching the servo ON signal from OFF to ON is greater than the value set in the buffer memory for the restart allowable range setting, the positioning operation is judged as on-standby and cannot be restarted.



## ■Setting method

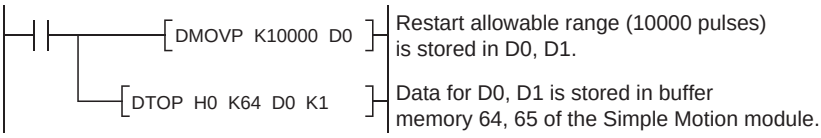
For performing restart at switching servo OFF to ON, set the restart allowable range in the following buffer memory.

n: Axis No. - 1

| Item | Setting range | Default value | Buffer memory address |
|---|---|---|---|
| [Pr.84] Restart allowable range when servo OFF to ON | 0, 1 to 327680 [pulse]<br>0: restart not allowed | 0 | 64+150n<br>65+150n |

• Setting example

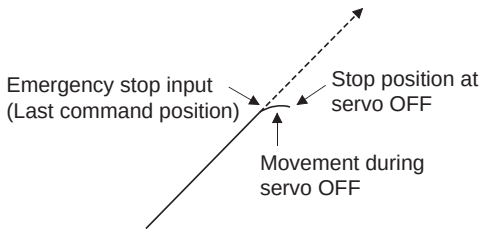
A program to set the restart allowable range for axis 1 to 10000 pulses is shown below.


DMOVP K10000 D0
Restart allowable range (10000 pulses) is stored in D0, D1.
DTOP H0 K64 D0 K1
Data for D0, D1 is stored in buffer memory 64, 65 of the Simple Motion module.

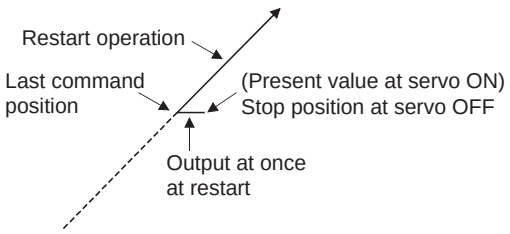
**Point**

- The difference between the last command position at servo OFF and the present value at servo ON is output at once at the first restart. If the restart allowable range is large at this time, an overload may occur on the servo side. Set a value which does not affect the mechanical system by output once to the restart allowable range when switching servo OFF to ON.
- The restart at switching servo OFF to ON is valid only at switching servo OFF to ON at the first time. At the second time or later, the setting for restart allowable range when switching servo OFF to ON is disregarded.
- Execute servo OFF when the mechanical system is in complete stop state. The restart at switching servo OFF to ON cannot be applied to a system in which the mechanical system is operated by external pressure or other force during servo OFF.
- Restart can be executed only while the axis operation status is "stop". Restart cannot be executed when the axis operation status is other than "stop".
- When the PLC READY signal is switched from OFF to ON during servo OFF, restart cannot be executed. If restart is requested, the warning "Restart not possible" (warning code: 0902H) occurs.
- Do not restart while a stop command is ON. When restart is executed during a stop, the error "Stop signal ON at start" (error code: 1908H) occurs and the axis operation status becomes "ERR". Therefore, restart cannot be performed even if the error is reset.
- Restart can also be executed while the positioning start signal is ON. However, do not set the positioning start signal from OFF to ON during a stop. If the positioning start signal is switched from OFF to ON, positioning is performed from the positioning data number set in "[Cd.3] Positioning start No." or from the positioning data number of the specified point.
- When positioning is terminated by a continuous-operation interrupt request, restart cannot be performed. If a restart request is executed, the warning "Restart not possible" (warning code: 0902H) occurs.

[Operation at emergency stop input]




[Operation at restart]



## [Pr.90] Operation setting for speed-torque control mode

Operation setting of the speed control mode, torque control mode or continuous operation to torque control mode at the speed-torque control is executed.

### ■Torque initial value selection

Set the torque initial value at switching to torque control mode or to continuous operation to torque control mode.

| Setting value | Details |
|---|---|
| 0: Command torque | Command torque value at switching. (following axis control data)<br>Switching to torque control mode: "[Cd.143] Command torque at torque control mode"<br>Switching to continuous operation to torque control mode: "[Cd.150] Target torque at continuous operation to torque control mode" |
| 1: Feedback torque | Motor torque value at switching. |

### ■Speed initial value selection

Set the initial speed at switching from position control mode to speed control mode or the initial speed at switching from position control mode or from speed control mode to continuous operation to torque control mode.

| Setting value | Details |
|---|---|
| 0: Command speed | Speed that position command at switching is converted into the motor speed. |
| 1: Feedback speed | Motor speed received from servo amplifier at switching |
| 2: Automatic selection | The lower speed between speed that position command at switching is converted into the motor speed and motor speed received from servo amplifier at switching. (This setting is valid only when continuous operation to torque control mode is used. At switching from position control mode to speed control mode, operation is the same as "0: Command speed".) |

### ■Condition selection at mode switching

Set the valid/invalid of switching conditions for switching control mode.

0: Switching conditions valid (for switching control mode)

1: Zero speed ON condition invalid (for switching control mode)

**Point**

- The "Operation setting for speed-torque control mode" is included in detailed parameters 2. However, it will be valid at the leading edge (OFF to ON) of the PLC READY signal [Y0].
- Set normally "0". Set "1" to shift to torque control without waiting for stop of servo motor immediately after positioning completion.

## [Pr.95] External command signal selection

Set the external command signal.

### ■RD77MS2

| Setting value | Details |
|---|---|
| 0: Not used | External command signal is not used. |
| 1: DI1 | DI1 is used as external command signal. |
| ⋮ | ⋮ |
| 10: DI10 | DI10 is used as external command signal. |

### ■RD77MS4/RD77MS8/RD77MS16

| Setting value | Details |
|---|---|
| 0: Not used | External command signal is not used. |
| 1: DI1 | DI1 is used as external command signal. |
| ⋮ | ⋮ |
| 20: DI20 | DI20 is used as external command signal. |

- Pin Nos. and input terminals corresponding to the external command signals (DI Nos.) are shown below.

| DI No. | Pin No. | Input terminal | DI No. | Pin No. | Input terminal |
|---|---|---|---|---|---|
| DI1 | 1A1 | SIN1 | DI11 | 2A1 | SIN11 |
| DI2 | 1A2 | SIN2 | DI12 | 2A2 | SIN12 |
| DI3 | 1A3 | SIN3 | DI13 | 2A3 | SIN13 |
| DI4 | 1A4 | SIN4 | DI14 | 2A4 | SIN14 |
| DI5 | 1A5 | SIN5 | DI15 | 2A5 | SIN15 |
| DI6 | 1B1 | SIN6 | DI16 | 2B1 | SIN16 |
| DI7 | 1B2 | SIN7 | DI17 | 2B2 | SIN17 |
| DI8 | 1B3 | SIN8 | DI18 | 2B3 | SIN18 |
| DI9 | 1B4 | SIN9 | DI19 | 2B4 | SIN19 |
| DI10 | 1B5 | SIN10 | DI20 | 2B5 | SIN20 |

**Point**

Same external command signal can be used in the multiple axes.

## [Pr.122] Manual pulse generator speed limit mode

Set how to output when the output by manual pulse generator operation exceeds "[Pr.123] Manual pulse generator speed limit value".

0: Don't hold speed limit

1: Don't output over value of speed limit

2: Output over value of speed limit later

## [Pr.123] Manual pulse generator speed limit value

Set the maximum speed during manual pulse generator operation.

**Point**

Set the "Manual pulse generator speed limit value" to a value less than "[Pr.8] Speed limit value". If the "speed limit value" is exceeded, the error "Manual pulse generator speed limit value error" (error code: 1ABAH) will occur.

# Home position return basic parameters

n: Axis No. - 1

| Item | Setting value, setting range | | Default value | Buffer memory address |
|---|---|---|---|---|
| | Value set with the engineering tool | Value set with a program | | |
| [Pr.43] Home position return method | 0: Near-point dog method | 0 | 0 | 70+150n |
| | 4: Count method 1 | 4 | | |
| | 5: Count method 2 | 5 | | |
| | 6: Data set method | 6 | | |
| | 7: Scale origin signal detection method | 7 | | |
| [Pr.44] Home position return direction | 0: Positive direction (address increment direction) | 0 | 0 | 71+150n |
| | 1: Negative direction (address decrement direction) | 1 | | |
| [Pr.45] Home position address | The setting value range differs depending on the "[Pr.1] Unit setting". | | 0 | 72+150n<br>73+150n |
| [Pr.46] Home position return speed | | | 1 | 74+150n<br>75+150n |
| [Pr.47] Creep speed | | | 1 | 76+150n<br>77+150n |
| [Pr.48] Home position return retry | 0: Do not retry home position return with limit switch | 0 | 0 | 78+150n |
| | 1: Retry home position return with limit switch | 1 | | |

## [Pr.43] Home position return method

Set the "home position return method" for carrying out machine home position return.

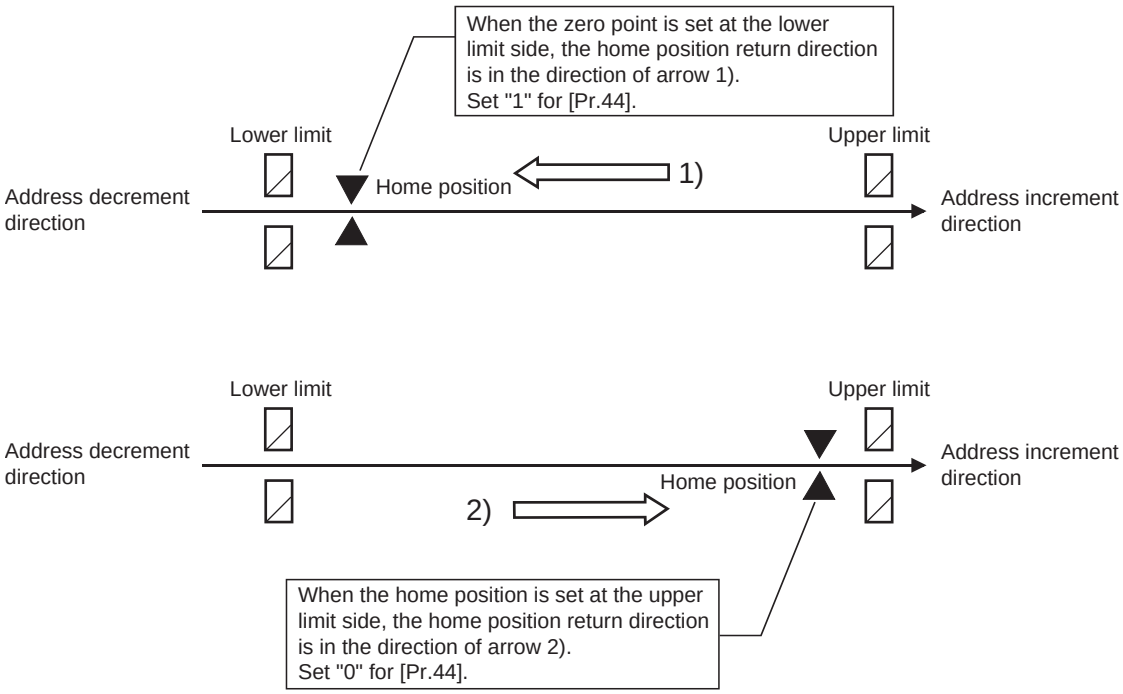
| Setting value | Details | Reference |
|---|---|---|
| 0: Near-point dog method | After decelerating at the near-point dog ON, stop at the zero signal and complete the machine home position return. | ☞ Page 35 Near-point dog method |
| 4: Count method 1 | After decelerating at the near-point dog ON, move the designated distance, and complete the machine home position return with the zero signal. | ☞ Page 37 Count method1 |
| 5: Count method 2 | After decelerating at the near-point dog ON, move the designated distance, and complete the machine home position return. | ☞ Page 39 Count method2 |
| 6: Data set method | The position where the machine home position return has been made will be the home position. | ☞ Page 41 Data set method |
| 7: Scale origin signal detection method | After deceleration stop at the near-point dog ON, move to the opposite direction against the home position return direction, and move to the home position return direction after deceleration stop once at the detection of the first zero signal. Then, it stops at the detected nearest zero signal, and completes the machine home position return. | ☞ Page 42 Scale origin signal detection method |

## [Pr.44] Home position return direction

Set the direction to start movement when starting machine home position return.

| Setting value | Details |
|---|---|
| 0: Positive direction (address increment direction) | Moves in the direction that the address increments. (Arrow 2)) |
| 1: Negative direction (address decrement direction) | Moves in the direction that the address decrements. (Arrow 1)) |

Normally, the home position is set near the lower limit or the upper limit, so "[Pr.44] Home position return direction" is set as shown below.


When the zero point is set at the lower limit side, the home position return direction is in the direction of arrow 1).
Set "1" for [Pr.44].
Lower limit
Upper limit
Address decrement direction
Home position
1)
Address increment direction
Lower limit
Upper limit
Address decrement direction
Home position
2)
Address increment direction
When the home position is set at the upper limit side, the home position return direction is in the direction of arrow 2).
Set "0" for [Pr.44].

## [Pr.45] Home position address

Set the address used as the reference point for positioning control (ABS system).

(When the machine home position return is completed, the stop position address is changed to the address set in "[Pr.45] Home position address". At the same time, the "[Pr.45] Home position address" is stored in "[Md.20] Current feed value" and "[Md.21] Machine feed value".)

| [Pr.1] setting value | Value set with the engineering tool (unit) | Value set with a program (unit) |
|---|---|---|
| 0: mm | -214748364.8 to 214748364.7 (μm) | -2147483648 to 2147483647 ( × $10^{-1}$ μm) |
| 1: inch | -21474.83648 to 21474.83647 (inch) | -2147483648 to 2147483647 ( × $10^{-5}$ inch) |
| 2: degree | 0 to 359.99999 (degree) | 0 to 35999999 ( × $10^{-5}$ degree) |
| 3: pulse | -2147483648 to 2147483647 (pulse) | -2147483648 to 2147483647 (pulse) |

## [Pr.46] Home position return speed

Set the speed for home position return.

| [Pr.1] setting value | Value set with the engineering tool (unit) | Value set with a program (unit) |
|---|---|---|
| 0: mm | 0.01 to 20000000.00 (mm/min) | 1 to 2000000000 ( × $10^{-2}$ mm/min) |
| 1: inch | 0.001 to 2000000.000 (inch/min) | 1 to 2000000000 ( × $10^{-3}$ inch/min) |
| 2: degree | 0.001 to 2000000.000 (degree/min)*1 | 1 to 2000000000 ( × $10^{-3}$ degree/min)*2 |
| 3: pulse | 1 to 1000000000 (pulse/s) | 1 to 1000000000 (pulse/s) |

*1 The range of home position return speed when "[Pr.83] Speed control 10 × multiplier setting for degree axis" is valid: 0.01 to 20000000.00 (degree/min)

*2 The range of home position return speed when "[Pr.83] Speed control 10 × multiplier setting for degree axis" is valid: 1 to 2000000000 (× $10^{-2}$ degree/min)

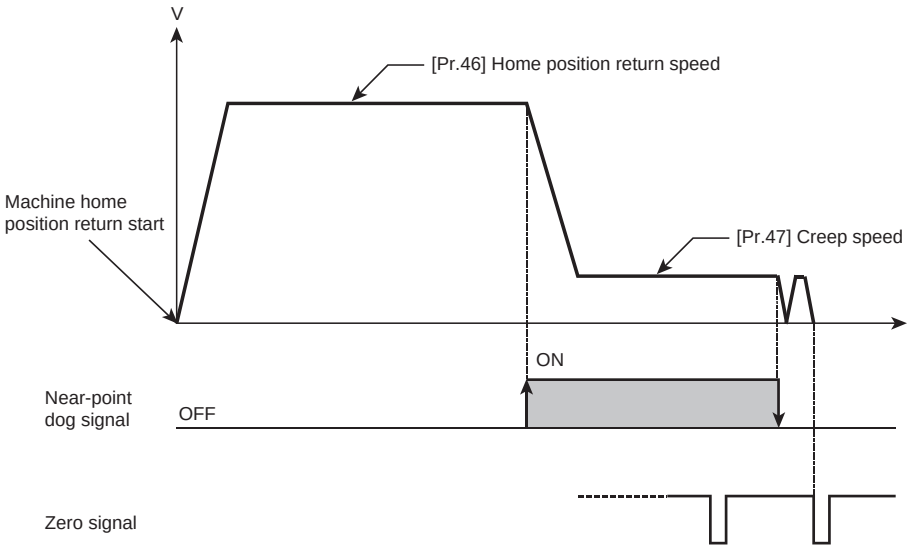
**Point**

Set the "home position return speed" to less than "[Pr.8] Speed limit value". If the "speed limit value" is exceeded, the error "Outside speed limit value range" (error code: 1A69H) will occur, and home position return will not be executed. The "home position return speed" should be equal to or faster than the "[Pr.7] Bias speed at start" and "[Pr.47] Creep speed".

## [Pr.47] Creep speed

Set the creep speed after near-point dog ON (the low speed just before stopping after decelerating from the home position return speed). The creep speed is set within the following range.

([Pr.46] Home position return speed) ≥ ([Pr.47] Creep speed) ≥ ([Pr.7] Bias speed at start)




| [Pr.1] setting value | Value set with the engineering tool (unit) | Value set with a program (unit) |
|---|---|---|
| 0: mm | 0.01 to 20000000.00 (mm/min) | 1 to 2000000000 ( × $10^{-2}$ mm/min) |
| 1: inch | 0.001 to 2000000.000 (inch/min) | 1 to 2000000000 ( × $10^{-3}$ inch/min) |
| 2: degree | 0.001 to 2000000.000 (degree/min)*1 | 1 to 2000000000 ( × $10^{-3}$ degree/min)*2 |
| 3: pulse | 1 to 1000000000 (pulse/s) | 1 to 1000000000 (pulse/s) |

*1 The range of home position return speed when "[Pr.83] Speed control 10 × multiplier setting for degree axis" is valid: 0.01 to 20000000.00 (degree/min)

*2 The range of home position return speed when "[Pr.83] Speed control 10 × multiplier setting for degree axis" is valid: 1 to 2000000000 (× $10^{-2}$ degree/min)

## [Pr.48] Home position return retry

Set whether to carry out home position return retry.

Refer to the following for the operation of home position return retry.

☞ Page 217 Home position return retry function

# Home position return detailed parameters

n: Axis No. - 1

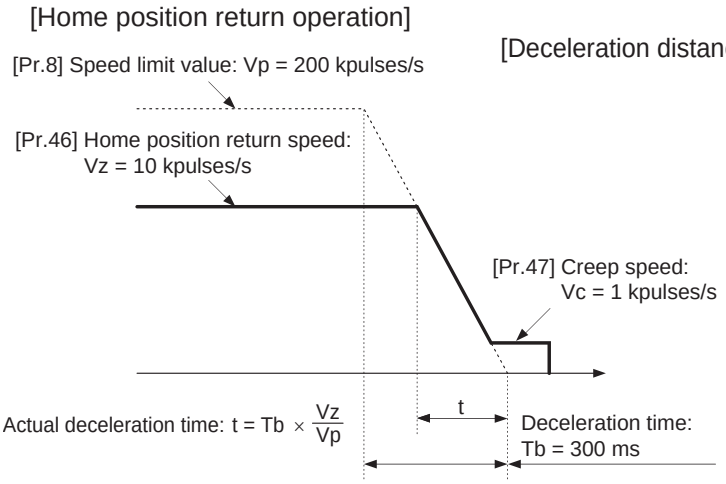
| Item | Setting value, setting range | | Default value | Buffer memory address |
|---|---|---|---|---|
| | Value set with the engineering tool | Value set with a program | | |
| [Pr.50]<br>Setting for the movement amount after near-point dog ON | The setting value range differs depending on the "[Pr.1] Unit setting". | | 0 | 80+150n<br>81+150n |
| [Pr.51]<br>Home position return acceleration time selection | 0: [Pr.9] Acceleration time 0 | 0 | 0 | 82+150n |
| | 1: [Pr.25] Acceleration time 1 | 1 | | |
| | 2: [Pr.26] Acceleration time 2 | 2 | | |
| | 3: [Pr.27] Acceleration time 3 | 3 | | |
| [Pr.52]<br>Home position return deceleration time selection | 0: [Pr.10] Deceleration time 0 | 0 | 0 | 83+150n |
| | 1: [Pr.28] Deceleration time 1 | 1 | | |
| | 2: [Pr.29] Deceleration time 2 | 2 | | |
| | 3: [Pr.30] Deceleration time 3 | 3 | | |
| [Pr.53]<br>Home position shift amount | The setting value range differs depending on the "[Pr.1] Unit setting". | | 0 | 84+150n<br>85+150n |
| [Pr.54]<br>Home position return torque limit value | 0.1 to 1000.0 (%) | 1 to 10000 (× 0.1%) | 3000 | 86+150n |
| [Pr.55]<br>Operation setting for incompletion of home position return | 0: Positioning control is not executed. | 0 | 0 | 87+150n |
| | 1: Positioning control is executed. | 1 | | |
| [Pr.56]<br>Speed designation during home position shift | 0: Home position return speed | 0 | 0 | 88+150n |
| | 1: Creep speed | 1 | | |
| [Pr.57]<br>Dwell time during home position return retry | 0 to 65535 (ms) | 0 to 65535 (ms)<br>0 to 32767: Set as a decimal<br>32768 to 65535: Convert into hexadecimal and set | 0 | 89+150n |

## [Pr.50] Setting for the movement amount after near-point dog ON

When using the count method 1 or 2, set the movement amount to the home position after the near-point dog signal turns ON. (The movement amount after near-point dog ON should be equal to or greater than the sum of the "distance covered by the deceleration from the home position return speed to the creep speed" and "distance of movement in 10 ms at the home position return speed".)

### ■Example of setting for "[Pr.50] Setting for the movement amount after near-point dog ON"

Assuming that the "[Pr.8] Speed limit value" is set to 200 kpulses/s, "[Pr.46] Home position return speed" to 10 kpulses/s, "[Pr.47] Creep speed" to 1 kpulses/s, and deceleration time to 300 ms, the minimum value of "[Pr.50] Setting for the movement amount after near-point dog ON" is calculated as follows:


[Home position return operation]
[Pr.8] Speed limit value: Vp = 200 kpulses/s
[Pr.46] Home position return speed:
Vz = 10 kpulses/s
[Pr.47] Creep speed:
Vc = 1 kpulses/s
Actual deceleration time: t = Tb × Vz/Vp
t
Deceleration time:
Tb = 300 ms

$$[\text{Deceleration distance}] = \frac{1}{2} \times \frac{Vz}{1000} \times t + \underbrace{0.01 \times Vz}_{\text{Movement amount for 10 ms at home position return speed.}}$$

$$= \frac{Vz}{2000} \times \frac{Tb \times Vz}{Vp} + 0.01 \times Vz$$

$$= \frac{10 \times 10^3}{2000} \times \frac{300 \times 10 \times 10^3}{200 \times 10^3} + 0.01 \times 10 \times 10^3$$

$$= 75 + 100$$

$$= 175$$

*: "[Pr.50] Setting for the movement amount after near-point dog ON" should be equal to or larger than 175.

| [Pr.1] setting value | Value set with the engineering tool (unit) | Value set with a program (unit) |
|---|---|---|
| 0: mm | 0 to 214748364.7 (μm) | 0 to 2147483647 ( × $10^{-1}$ μm) |
| 1: inch | 0 to 21474.83647 (inch) | 0 to 2147483647 ( × $10^{-5}$ inch) |
| 2: degree | 0 to 21474.83647 (degree) | 0 to 2147483647 ( × $10^{-5}$ degree) |
| 3: pulse | 0 to 2147483647 (pulse) | 0 to 2147483647 (pulse) |

## [Pr.51] Home position return acceleration time selection

Set which of "acceleration time 0 to 3" to use for the acceleration time during home position return.

0: Use the value set in "[Pr.9] Acceleration time 0".

1: Use the value set in "[Pr.25] Acceleration time 1".

2: Use the value set in "[Pr.26] Acceleration time 2".

3: Use the value set in "[Pr.27] Acceleration time 3".

## [Pr.52] Home position return deceleration time selection

Set which of "deceleration time 0 to 3" to use for the deceleration time during home position return.

0: Use the value set in "[Pr.10] Deceleration time 0".

1: Use the value set in "[Pr.28] Deceleration time 1".

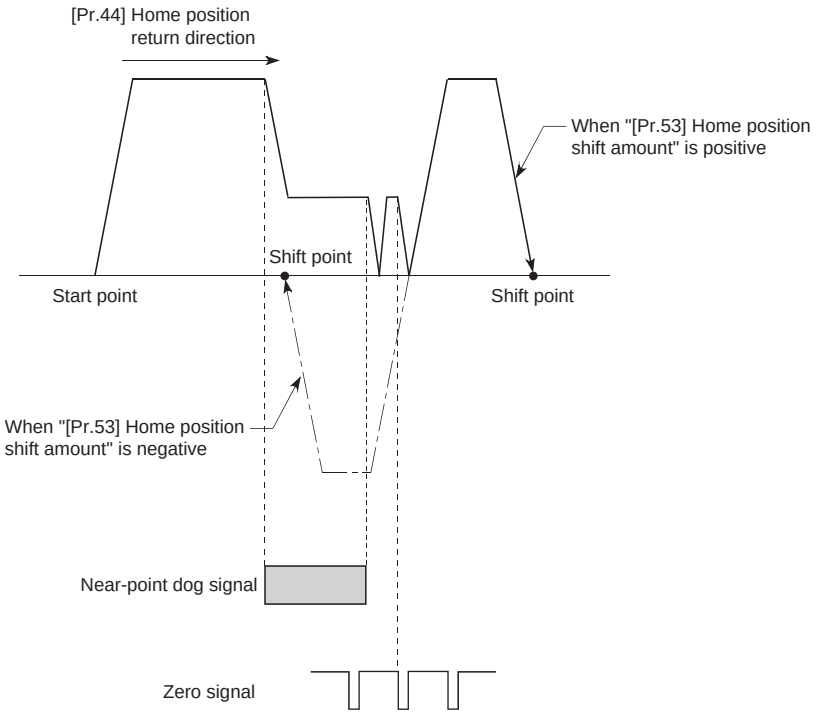
2: Use the value set in "[Pr.29] Deceleration time 2".

3: Use the value set in "[Pr.30] Deceleration time 3".

## [Pr.53] Home position shift amount

Set the amount to shift (move) from the position stopped at with machine home position return.

*1 The home position shift function is used to compensate the home position stopped at with machine home position return. If there is a physical limit to the home position, due to the relation of the near-point dog installation position, use this function to compensate the home position to an optimum position.


[Pr.44] Home position return direction
When "[Pr.53] Home position shift amount" is positive
Shift point
Start point
Shift point
When "[Pr.53] Home position shift amount" is negative
Near-point dog signal
Zero signal

| [Pr.1] setting value | Value set with the engineering tool (unit) | Value set with a program (unit) |
|---|---|---|
| 0: mm | -214748364.8 to 214748364.7 (μm) | -2147483648 to 2147483647 ( × $10^{-1}$ μm) |
| 1: inch | -21474.83648 to 21474.83647 (inch) | -2147483648 to 2147483647 ( × $10^{-5}$ inch) |
| 2: degree | -21474.83648 to 21474.83647 (degree) | -2147483648 to 2147483647 ( × $10^{-5}$ degree) |
| 3: pulse | -2147483648 to 2147483647 (pulse) | -2147483648 to 2147483647 (pulse) |

## [Pr.54] Home position return torque limit value

Set the value to limit the servomotor torque after reaching the creep speed during machine home position return.

Refer to the following for details on the torque limits.

☞ Page 235 Torque limit function

## [Pr.55] Operation setting for incompletion of home position return

Set whether the positioning control is executed or not (When the home position return request flag is ON.).

0: Positioning control is not executed.

1: Positioning control is executed.

- When the home position return request flag is ON, selecting "0: Positioning control is not executed" will result in the error "Start at home position return incomplete" (error code: 19A6H), and positioning control will not be performed. At this time, operation with the manual control (JOG operation, inching operation, manual pulse generator operation) is available. The positioning control can be executed even if the home position return request flag is ON when selecting "1: Positioning control is executed".
- The following shows whether the positioning control is possible to start/restart or not when selecting "0: Positioning control is not executed".

| | |
|---|---|
| Start possible | Machine home position return, JOG operation, inching operation, manual pulse generator operation, and current value changing using current value changing start No. (9003) |
| Start/restart impossible control | When the following cases at block start, condition start, wait start, repeated start, multiple axes simultaneous start and pre-reading start<br>1-axis linear control, 2/3/4-axis linear interpolation control, 1/2/3/4-axis fixed-feed control, 2-axis circular interpolation control (with sub point designation/center point designation), 3-axis helical interpolation control (with sub point designation/center point designation), 1/2/3/4-axis speed control, speed-position switching control (INC mode/ ABS mode), position-speed switching control, and current value changing using current value changing (No.1 to 600) |

- When the home position return request flag is ON, starting the fast home position return will result in the error "Home position return request ON" (error code: 1945H) despite the setting value of "Operation setting for incompletion of home position return", and the fast home position return will not be executed.

### ⚠CAUTION

- Do not execute the positioning control in home position return request signal ON for the axis which uses in the positioning control. Failure to observe this could lead to an accident such as a collision.

## [Pr.56] Speed designation during home position shift

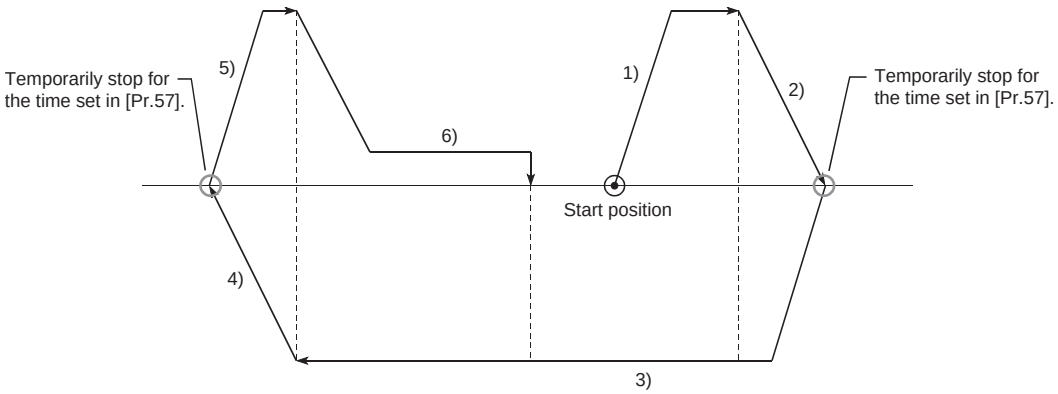
Set the operation speed for when a value other than "0" is set for "[Pr.53] Home position shift amount". Select the setting from "[Pr.46] Home position return speed" or "[Pr.47] Creep speed".

0: Designate "[Pr.46] Home position return speed" as the setting value.

1: Designate "[Pr.47] Creep speed" as the setting value.

## [Pr.57] Dwell time during home position return retry

When home position return retry is validated (when "1" is set for [Pr.48]), set the stop time after decelerating in 2) and 4) in the following drawing.



# Expansion parameters

n: Axis No. - 1

| Item | Setting value, setting range | | Default value | Buffer memory address |
|---|---|---|---|---|
| | Value set with the engineering tool | Value set with a program | | |
| [Pr.91]<br>Optional data monitor: Data type setting 1 | 0: No setting<br>1: Effective load ratio*2<br>2: Regenerative load ratio<br>3: Peak load factor<br>4: Load inertia moment ratio*2<br>5: Model loop gain*2<br>6: Bus voltage*2<br>7: Servo motor rotation speed*2<br>8: Encoder multiple revolution counter<br>9: Module power consumption<br>10: Instantaneous torque*2<br>12: Servomotor thermistor temperature<br>13: Equivalent disturbance torque*2<br>14: Overload alarm margin<br>15: Error excessive alarm margin<br>16: Settling time<br>17: Overshoot amount<br>20: Position feedback*1<br>21: Encoder single revolution position*1<br>22: Selection droop pulse*1<br>23: Module integral power consumption*1<br>24: Load side encoder information 1*1<br>25: Load side encoder information 2*1<br>26: Z-phase counter*1<br>27: Servomotor side/load-side position deviation*1<br>28: Servomotor side/load-side speed deviation*1<br>30: Module power consumption (2 words)*1 | 0<br>1<br>2<br>3<br>4<br>5<br>6<br>7<br>8<br>9<br>10<br>12<br>13<br>14<br>15<br>16<br>17<br>20<br>21<br>22<br>23<br>24<br>25<br>26<br>27<br>28<br>30 | 0 | 100+150n |
| [Pr.92]<br>Optional data monitor: Data type setting 2 | | | 0 | 101+150n |
| [Pr.93]<br>Optional data monitor: Data type setting 3 | | | 0 | 102+150n |
| [Pr.94]<br>Optional data monitor: Data type setting 4 | | | 0 | 103+150n |

*1 Used point: 2 words

*2 The name differs depending on the connected device.

## [Pr.91] to [Pr.94] Optional data monitor: Data type setting 1/2/3/4

Set the data type monitored in optional data monitor function.

| Setting value | Data type | Used point |
|---|---|---|
| 0 | No setting*1 | 1 word |
| 1 | Effective load ratio*2 | |
| 2 | Regenerative load ratio | |
| 3 | Peak load factor | |
| 4 | Load inertia moment ratio*2 | |
| 5 | Model loop gain*2 | |
| 6 | Bus voltage*2 | |
| 7 | Servo motor rotation speed*2 | |
| 8 | Encoder multiple revolution counter | |
| 9 | Module power consumption | |
| 10 | Instantaneous torque*2 | |
| 12 | Servomotor thermistor temperature | |
| 13 | Equivalent disturbance torque*2 | |
| 14 | Overload alarm margin | |
| 15 | Error excessive alarm margin | |
| 16 | Settling time | |
| 17 | Overshoot amount | |
| 20 | Position feedback | 2 words |
| 21 | Encoder single revolution position | |
| 22 | Selection droop pulse | |
| 23 | Module integral power consumption | |
| 24 | Load side encoder information 1 | |
| 25 | Load side encoder information 2 | |
| 26 | Z-phase counter | |
| 27 | Servomotor side/load-side position deviation | |
| 28 | Servomotor side/load-side speed deviation | |
| 30 | Module power consumption (2 words) | |

*1 The stored value of "[Md.109] Regenerative load ratio/Optional data monitor output 1" to "[Md.112] Optional data monitor output 4" is different every data type setting 1 to 4. (☞ Page 477 Axis monitor data)

*2 The name differs depending on the connected device.

**Point**

- The monitor address of optional data monitor is registered to servo amplifier with initialized communication after power supply ON or CPU module reset.
- Set the data type of "used point: 2 words" in "[Pr.91] Optional data monitor: Data type setting 1" or "[Pr.93] Optional data monitor: Data type setting 3". If it is set in "[Pr.92] Optional data monitor: Data type setting 2" or "[Pr.94] Optional data monitor: Data type setting 4", the warning "Optional data monitor data type setting error" (warning code: 0933H) will occur with initialized communication to servo amplifier and "0" will be set in [Md.109] to [Md.112].
- Set "0" in "[Pr.92] Optional data monitor: Data type setting 2" when the data type of "used point: 2 words" is set in "[Pr.91] Optional data monitor: Data type setting 1", and set "0" in "[Pr.94] Optional data monitor: Data type setting 4" when the data type of "used point: 2 words" is set in "[Pr.93] Optional data monitor: Data type setting 3". When setting other than "0", the warning "Optional data monitor data type setting error" (warning code: 0933H) will occur with initialized communication to servo amplifier and "0" will be set in [Md.109] to [Md.112].
- When the data type of "used point: 2 words" is set, the monitor data of low-order is "[Md.109] Regenerative load ratio/Optional data monitor output 1" or "[Md.111] Peak torque ratio/Optional data monitor output 3".
- Refer to ☞ Page 340 Optional Data Monitor Function for the data type that can be monitored on each servo amplifier. When the data type that cannot be monitored is set, "0" is stored to the monitor output.

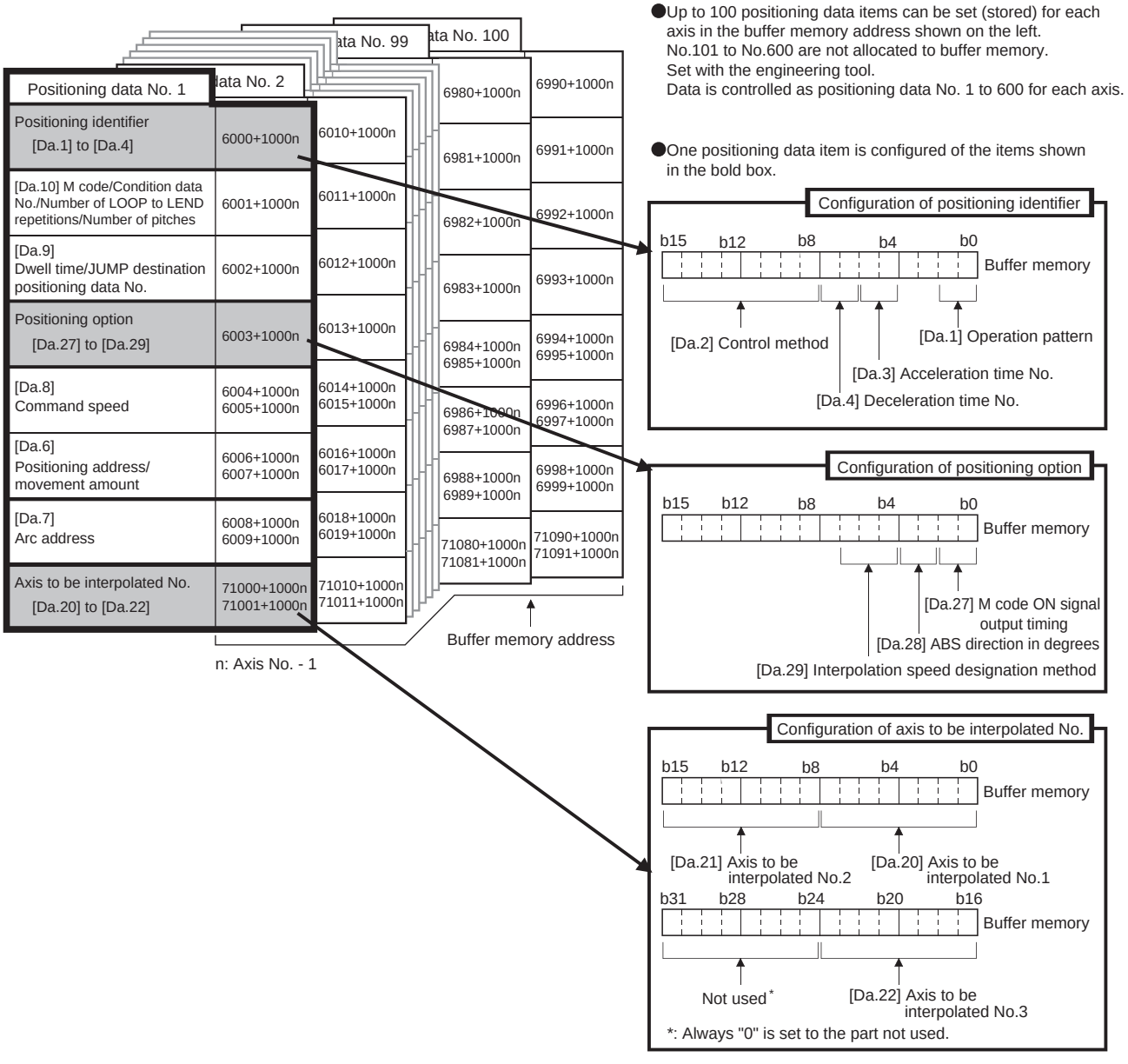
## Servo parameters

Refer to each servo amplifier instruction manual for details of the parameter list and setting items for MR-J4(W)-B/MR-JE-B/MR-J3(W)-B. Do not change other than the buffer memory addresses of the parameters described in each servo amplifier instruction manual.

# 12.4 Positioning Data

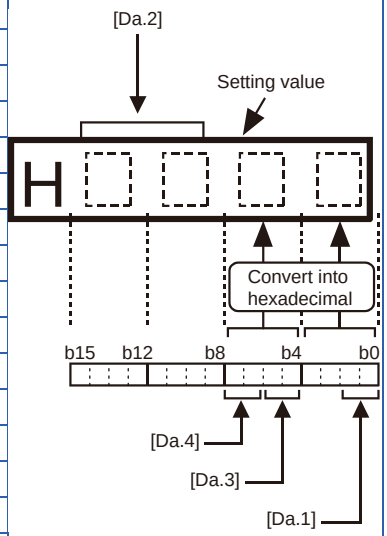
Before explaining the positioning data setting items [Da.1] to [Da.10], [Da.20] to [Da.22], [Da.27] to [Da.29], the configuration of the positioning data is shown below.

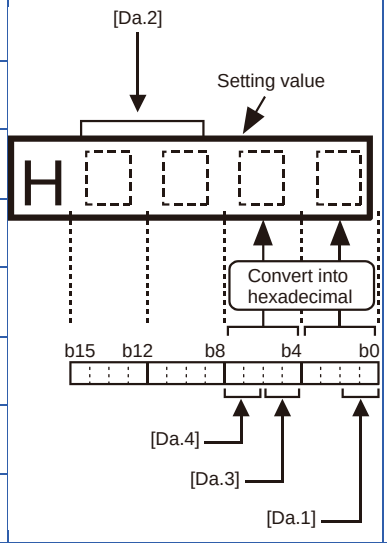
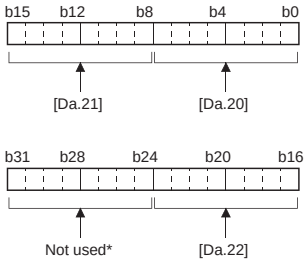
The positioning data stored in the buffer memory of the Simple Motion module is the following configuration.

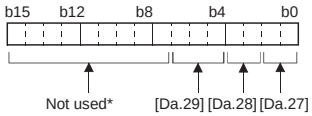


The following explains the positioning data setting items [Da.1] to [Da.10], [Da.20] to [Da.22] and [Da.27] to [Da.29]. (The buffer memory addresses shown are those of the "positioning data No.1".)

n: Axis No. - 1

| Item | | Setting value | | | Default value | Buffer memory address |
|---|---|---|---|---|---|---|
| | | Value set with the engineering tool | Value set with a program | | | |
| Positioning identifier | [Da.1] Operation pattern | 00: Positioning complete | 00 |  | 0000H | 6000+1000n |
| | | 01: Continuous positioning control | 01 | | | |
| | | 11: Continuous path control | 11 | | | |
| | [Da.2] Control method | 01H: ABS Linear 1 | 01H | | | |
| | | 02H: INC Linear 1 | 02H | | | |
| | | 03H: Feed 1 | 03H | | | |
| | | 04H: FWD V1 | 04H | | | |
| | | 05H: RVS V1 | 05H | | | |
| | | 06H: FWD V/P | 06H | | | |
| | | 07H: RVS V/P | 07H | | | |
| | | 08H: FWD P/V | 08H | | | |
| | | 09H: RVS P/V | 09H | | | |
| | | 0AH: ABS Linear 2 | 0AH | | | |
| | | 0BH: INC Linear 2 | 0BH | | | |
| | | 0CH: Feed 2 | 0CH | | | |
| | | 0DH: ABS ArcMP | 0DH | | | |
| | | 0EH: INC ArcMP | 0EH | | | |
| | | 0FH: ABS ArcRGT | 0FH | | | |
| | | 10H: ABS ArcLFT | 10H | | | |
| | | 11H: INC ArcRGT | 11H | | | |
| | | 12H: INC ArcLFT | 12H | | | |
| | | 13H: FWD V2 | 13H | | | |
| | | 14H: RVS V2 | 14H | | | |
| | | 15H: ABS Linear 3 | 15H | | | |
| | | 16H: INC Linear 3 | 16H | | | |
| | | 17H: Feed 3 | 17H | | | |
| | | 18H: FWD V3 | 18H | | | |
| | | 19H: RVS V3 | 19H | | | |
| | | 1AH: ABS Linear 4 | 1AH | | | |
| | | 1BH: INC Linear 4 | 1BH | | | |
| | | 1CH: Feed 4 | 1CH | | | |
| | | 1DH: FWD V4 | 1DH | | | |
| | | 1EH: RVS V4 | 1EH | | | |
| | | 20H: Helical interpolation control with sub point specified (ABS) | 20H | | | |
| | | 21H: Helical interpolation control with sub point specified (INC) | 21H | | | |
| | | 22H: Helical interpolation control with center point specified (ABS, CW) | 22H | | | |
| | | 23H: Helical interpolation control with center point specified (ABS, CCW) | 23H | | | |
| | | 24H: Helical interpolation control with center point specified (INC, CW) | 24H | | | |
| | | 25H: Helical interpolation control with center point specified (INC, CCW) | 25H | | | |
| | | 80H: NOP | 80H | | | |
| | | 81H: Address CHG | 81H | | | |
| | | 82H: JUMP | 82H | | | |
| | | 83H: LOOP | 83H | | | |
| | | 84H: LEND | 84H | | | |

| Item | | Setting value | | | Default value | Buffer memory address |
|---|---|---|---|---|---|---|
| | | Value set with the engineering tool | Value set with a program | | | |
| Positioning identifier | [Da.3] Acceleration time No. | 0: [Pr.9] Acceleration time 0 | 00 |  | 0000H | 6000+1000n |
| | | 1: [Pr.25] Acceleration time 1 | 01 | | | |
| | | 2: [Pr.26] Acceleration time 2 | 10 | | | |
| | | 3: [Pr.27] Acceleration time 3 | 11 | | | |
| | [Da.4] Deceleration time No. | 0: [Pr.10] Deceleration time 0 | 00 | | | |
| | | 1: [Pr.28] Deceleration time 1 | 01 | | | |
| | | 2: [Pr.29] Deceleration time 2 | 10 | | | |
| | | 3: [Pr.30] Deceleration time 3 | 11 | | | |
| [Da.6] Positioning address/ movement amount | | The setting value range differs according to the "[Da.2] Control method". | | | 0 | 6006+1000n 6007+1000n |
| [Da.7] Arc address | | | | | 0 | 6008+1000n 6009+1000n |
| [Da.8] Command speed | | The setting value range differs depending on the "[Pr.1] Unit setting". | | | 0 | 6004+1000n 6005+1000n |
| | | -1: Current speed (Speed set for previous positioning data No.) | -1 | | | |
| [Da.9] Dwell time/ JUMP destination positioning data No. | Dwell time | The setting value range differs according to the "[Da.2] Control method". | | | 0 | 6002+1000n |
| | JUMP destination positioning data No. | | | | | |
| [Da.10] M code/ Condition data No./ Number of LOOP to LEND repetitions/ Number of pitches | M code | | | | 0 | 6001+1000n |
| | Condition data No. | | | | | |
| | Number of LOOP to LEND repetitions | | | | | |
| Axis to be interpolated | [Da.20] Axis to be interpolated No.1 | 0: Axis 1 selected | 0H |  | 0000H | 71000+1000n 71001+1000n |
| | [Da.21] Axis to be interpolated No.2 | 1: Axis 2 selected | 1H | | | |
| | | 2: Axis 3 selected | 2H | | | |
| | | 3: Axis 4 selected | 3H | | | |
| | | 4: Axis 5 selected | 4H | | | |
| | | 5: Axis 6 selected | 5H | | | |
| | | 6: Axis 7 selected | 6H | | | |
| | | 7: Axis 8 selected | 7H | | | |
| | | 8: Axis 9 selected | 8H | | | |
| | | 9: Axis 10 selected | 9H | | | |
| | | A: Axis 11 selected | AH | | | |
| | [Da.22] Axis to be interpolated No.3 | B: Axis 12 selected | BH | | | |
| | | C: Axis 13 selected | CH | | | |
| | | D: Axis 14 selected | DH | | | |
| | | E: Axis 15 selected | EH | | | |
| | | F: Axis 16 selected | FH | | | |

| Item | | Setting value | | | Default value | Buffer memory address |
|---|---|---|---|---|---|---|
| | | Value set with the engineering tool | Value set with a program | | | |
| Positioning option | [Da.27] M code ON signal output timing | 0: Uses the setting value of "[Pr.18] M code ON signal output timing".<br>1: WITH mode<br>2: AFTER mode | 0<br>1<br>2 |  <br>*: Always "0" is set to the part not used. | 0000H | 6003+1000n |
| | [Da.28] ABS direction in degrees | 0: Uses the setting value of "[Cd.40] ABS direction in degrees".<br>1: ABS circular right<br>2: ABS circular left<br>3: Takes a shortcut. (Specified direction ignored.) | 0<br>1<br>2<br>3 | | | |
| | [Da.29] Interpolation speed designation method | 0: Uses the setting value of "[Pr.20] Interpolation speed designation method".<br>1: Composite speed<br>2: Reference axis speed | 0<br>1<br>2 | | | |

## [Da.1] Operation pattern

The operation pattern designates whether positioning of a certain data No. is to be ended with just that data, or whether the positioning for the next data No. is to be carried out in succession.

| Operation pattern | Setting value | Details |
|---|---|---|
| Positioning complete | 00 | Set to execute positioning to the designated address, and then complete positioning. |
| Continuous positioning control | 01 | Positioning is carried out successively in order of data Nos. with one start signal. The operation halts at each position indicated by a positioning data. |
| Continuous path control | 11 | Positioning is carried out successively in order of data Nos. with one start signal. The operation does not stop at each positioning data. |

## [Da.2] Control method

Set the "control method" for carrying out positioning control.

**Point**

- When "JUMP instruction" is set for the control method, the "[Da.9] Dwell time/JUMP destination positioning data No." and "[Da.10] M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches" setting details will differ.
- In case you selected "LOOP" as the control method, the "[Da.10] M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches" should be set differently from other cases.
- Refer to the following for details on the control methods.

☞ Page 48 MAJOR POSITIONING CONTROL

- If "degree" is set for "[Pr.1] Unit setting", circular interpolation control and 3-axis helical interpolation control cannot be carried out. (The error "Circular interpolation not possible" (error code: 199FH) will occur when executed.)

## [Da.3] Acceleration time No.

Set which of "acceleration time 0 to 3" to use for the acceleration time during positioning.

0: Use the value set in "[Pr.9] Acceleration time 0".

1: Use the value set in "[Pr.25] Acceleration time 1".

2: Use the value set in "[Pr.26] Acceleration time 2".

3: Use the value set in "[Pr.27] Acceleration time 3".

## [Da.4] Deceleration time No.

Set which of "deceleration time 0 to 3" to use for the deceleration time during positioning.

0: Use the value set in "[Pr.10] Deceleration time 0".

1: Use the value set in "[Pr.28] Deceleration time 1".

2: Use the value set in "[Pr.29] Deceleration time 2".

3: Use the value set in "[Pr.30] Deceleration time 3".

## [Da.6] Positioning address/movement amount

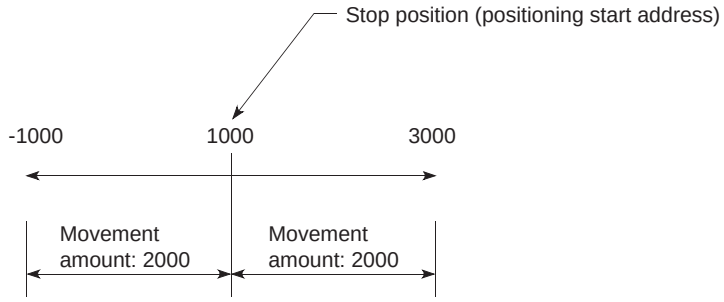
Set the address to be used as the target value for positioning control.

The setting value range differs according to the "[Da.2] Control method".



### ■Absolute (ABS) system, current value changing

- The setting value (positioning address) for the ABS system and current value changing is set with an absolute address (address from home position).

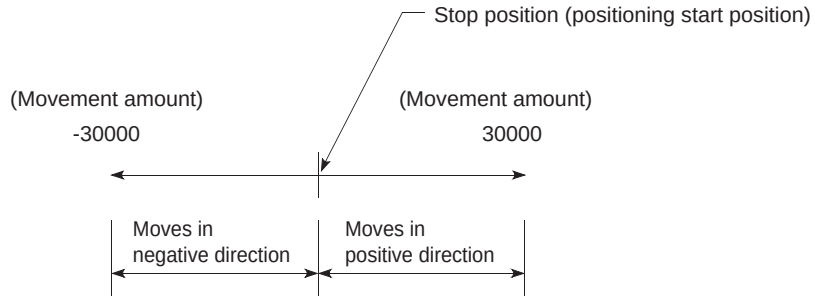



### ■Incremental (INC) system, fixed-feed 1, fixed-feed 2, fixed-feed 3, fixed-feed 4

- The setting value (movement amount) for the INC system is set as a movement amount with sign.

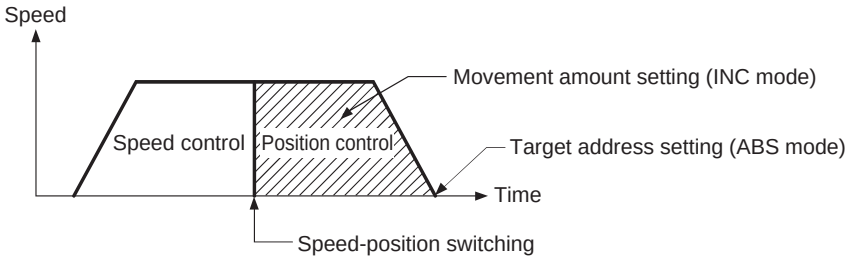
When movement amount is positive: Moves in the positive direction (address increment direction)

When movement amount is negative: Moves in the negative direction (address decrement direction)




### ■Speed-position switching control

- INC mode: Set the amount of movement after the switching from speed control to position control.
- ABS mode: Set the absolute address which will be the target value after speed control is switched to position control. (The unit is "degree" only)



## ■Position-speed switching control

• Set the amount of movement before the switching from position control to speed control.

● When "[Pr.1] Unit setting" is "mm"

The table below lists the control methods that require the setting of the positioning address or movement amount and the associated setting ranges.

(With any control method excluded from the table below, neither the positioning address nor the movement amount needs to be set.)

| [Da.2] setting value | Value set with the engineering tool (μm) | Value set with a program*1 ( × $10^{-1}$ μm) |
|---|---|---|
| ABS Linear 1: 01H<br>ABS Linear 2: 0AH<br>ABS Linear 3: 15H<br>ABS Linear 4: 1AH<br>Current value changing: 81H | • Set the address<br>-214748364.8 to 214748364.7 | • Set the address<br>-2147483648 to 2147483647 |
| INC Linear 1: 02H<br>INC Linear 2: 0BH<br>INC Linear 3: 16H<br>INC Linear 4: 1BH<br>Fixed-feed 1: 03H<br>Fixed-feed 2: 0CH<br>Fixed-feed 3: 17H<br>Fixed-feed 4: 1CH | • Set the movement amount<br>-214748364.8 to 214748364.7 | • Set the movement amount<br>-2147483648 to 2147483647 |
| Forward run speed/position: 06H<br>Reverse run speed/position: 07H<br>Forward run position/speed: 08H<br>Reverse run position/speed: 09H | • Set the movement amount<br>0 to 214748364.7 | • Set the movement amount<br>0 to 2147483647 |
| ABS circular sub: 0DH<br>ABS circular right: 0FH<br>ABS circular left: 10H | • Set the address<br>-214748364.8 to 214748364.7 | • Set the address<br>-2147483648 to 2147483647 |
| INC circular sub: 0EH<br>INC circular right: 11H<br>INC circular left: 12H | • Set the movement amount<br>-214748364.8 to 214748364.7 | • Set the movement amount<br>-2147483648 to 2147483647 |
| ABS helical sub: 20H<br>ABS helical right: 22H<br>ABS helical left: 24H | • Set the address<br>-214748364.8 to 214748364.7 | • Set the address<br>-2147483648 to 2147483647 |
| INC helical sub: 21H<br>INC helical right: 23H<br>INC helical left: 25H | • Set the movement amount<br>-214748364.8 to 214748364.7 | • Set the movement amount<br>-2147483648 to 2147483647 |

*1 Set an integer because the program cannot handle fractions.
(The value will be converted properly within the system.)

● When "[Pr.1] Unit setting" is "degree"

The table below lists the control methods that require the setting of the positioning address or movement amount and the associated setting ranges.

(With any control method excluded from the table below, neither the positioning address nor the movement amount needs to be set.)

| [Da.2] setting value | Value set with the engineering tool (degree) | Value set with a program*1 ( × $10^{-5}$ degree) |
|---|---|---|
| ABS Linear 1: 01H<br>ABS Linear 2: 0AH<br>ABS Linear 3: 15H<br>ABS Linear 4: 1AH<br>Current value changing: 81H | • Set the address<br>0 to 359.99999 | • Set the address<br>0 to 35999999 |
| INC Linear 1: 02H<br>INC Linear 2: 0BH<br>INC Linear 3: 16H<br>INC Linear 4: 1BH<br>Fixed-feed 1: 03H<br>Fixed-feed 2: 0CH<br>Fixed-feed 3: 17H<br>Fixed-feed 4: 1CH | • Set the movement amount<br>-21474.83648 to 21474.83647 | • Set the movement amount<br>-2147483648 to 2147483647*2 |
| Forward run speed/position: 06H<br>Reverse run speed/position: 07H | In INC mode<br>• Set the movement amount<br>0 to 21474.83647<br>In ABS mode<br>• Set the address<br>0 to 359.99999 | In INC mode<br>• Set the movement amount<br>0 to 2147483647<br>In ABS mode<br>• Set the address<br>0 to 35999999 |
| Forward run position/speed: 08H<br>Reverse run position/speed: 09H | • Set the movement amount<br>0 to 21474.83647 | • Set the movement amount<br>0 to 2147483647 |
| ABS helical sub: 20H*3<br>ABS helical right: 22H*3<br>ABS helical left: 24H*3 | • Set the address<br>0 to 359.99999 | • Set the address<br>0 to 35999999 |
| INC helical sub: 21H*3<br>INC helical right: 23H*3<br>INC helical left: 25H*3 | • Set the movement amount<br>-21474.83648 to 21474.83647 | • Set the movement amount<br>-2147483648 to 2147483647*2 |

*1 Set an integer because the program cannot handle fractions.
(The value will be converted properly within the system.)

*2 When the software stroke limit is valid, -35999999 to 35999999 is set.

*3 The axis where "degree" can be set in the 3-axis helical interpolation control is only the linear interpolation axis.

● When "[Pr.1] Unit setting" is "pulse"

The table below lists the control methods that require the setting of the positioning address or movement amount and the associated setting ranges.

(With any control method excluded from the table below, neither the positioning address nor the movement amount needs to be set.)

| [Da.2] setting value | Value set with the engineering tool (pulse) | Value set with a program (pulse) |
|---|---|---|
| ABS Linear 1: 01H<br>ABS Linear 2: 0AH<br>ABS Linear 3: 15H<br>ABS Linear 4: 1AH<br>Current value changing: 81H | • Set the address<br>-2147483648 to 2147483647 | • Set the address<br>-2147483648 to 2147483647 |
| INC Linear 1: 02H<br>INC Linear 2: 0BH<br>INC Linear 3: 16H<br>INC Linear 4: 1BH<br>Fixed-feed 1: 03H<br>Fixed-feed 2: 0CH<br>Fixed-feed 3: 17H<br>Fixed-feed 4: 1CH | • Set the movement amount<br>-2147483648 to 2147483647 | • Set the movement amount<br>-2147483648 to 2147483647 |
| Forward run speed/position: 06H<br>Reverse run speed/position: 07H<br>Forward run position/speed: 08H<br>Reverse run position/speed: 09H | • Set the movement amount<br>0 to 2147483647 | • Set the movement amount<br>0 to 2147483647 |
| ABS circular sub: 0DH<br>ABS circular right: 0FH<br>ABS circular left: 10H | • Set the address<br>-2147483648 to 2147483647 | • Set the address<br>-2147483648 to 2147483647 |
| INC circular sub: 0EH<br>INC circular right: 11H<br>INC circular left: 12H | • Set the movement amount<br>-2147483648 to 2147483647 | • Set the movement amount<br>-2147483648 to 2147483647 |
| ABS helical sub: 20H<br>ABS helical right: 22H<br>ABS helical left: 24H | • Set the address<br>-2147483648 to 2147483647 | • Set the address<br>-2147483648 to 2147483647 |
| INC helical sub: 21H<br>INC helical right: 23H<br>INC helical left: 25H | • Set the movement amount<br>-2147483648 to 2147483647 | • Set the movement amount<br>-2147483648 to 2147483647 |

● When "[Pr.1] Unit setting" is "inch"

The table below lists the control methods that require the setting of the positioning address or movement amount and the associated setting ranges.

(With any control method excluded from the table below, neither the positioning address nor the movement amount needs to be set.)

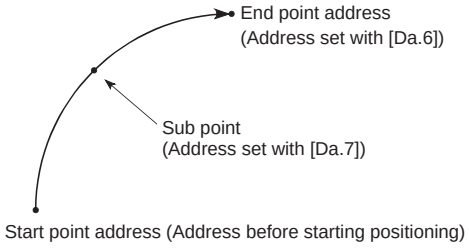
| [Da.2] setting value | Value set with the engineering tool (inch) | Value set with a program*1 ( × $10^{-5}$ inch) |
|---|---|---|
| ABS Linear 1: 01H<br>ABS Linear 2: 0AH<br>ABS Linear 3: 15H<br>ABS Linear 4: 1AH<br>Current value changing: 81H | • Set the address<br>-21474.83648 to 21474.83647 | • Set the address<br>-2147483648 to 2147483647 |
| INC Linear 1: 02H<br>INC Linear 2: 0BH<br>INC Linear 3: 16H<br>INC Linear 4: 1BH<br>Fixed-feed 1: 03H<br>Fixed-feed 2: 0CH<br>Fixed-feed 3: 17H<br>Fixed-feed 4: 1CH | • Set the movement amount<br>-21474.83648 to 21474.83647 | • Set the movement amount<br>-2147483648 to 2147483647 |
| Forward run speed/position: 06H<br>Reverse run speed/position: 07H<br>Forward run position/speed: 08H<br>Reverse run position/speed: 09H | • Set the movement amount<br>0 to 21474.83647 | • Set the movement amount<br>0 to 2147483647 |
| ABS circular sub: 0DH<br>ABS circular right: 0FH<br>ABS circular left: 10H | • Set the address<br>-21474.83648 to 21474.83647 | • Set the address<br>-2147483648 to 2147483647 |
| INC circular sub: 0EH<br>INC circular right: 11H<br>INC circular left: 12H | • Set the movement amount<br>-21474.83648 to 21474.83647 | • Set the movement amount<br>-2147483648 to 2147483647 |
| ABS helical sub: 20H<br>ABS helical right: 22H<br>ABS helical left: 24H | • Set the address<br>-21474.83648 to 21474.83647 | • Set the address<br>-2147483648 to 2147483647 |
| INC helical sub: 21H<br>INC helical right: 23H<br>INC helical left: 25H | • Set the movement amount<br>-21474.83648 to 21474.83647 | • Set the movement amount<br>-2147483648 to 2147483647 |

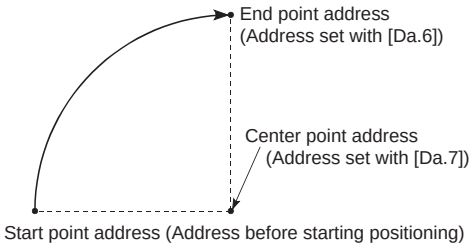
*1 Set an integer because the program cannot handle fractions.
(The value will be converted properly within the system.)

## [Da.7] Arc address

The arc address is data required only when carrying out circular interpolation control or 3-axis helical interpolation control.

- When carrying out circular interpolation with sub point designation, set the sub point (passing point) address as the arc address.
- When carrying out circular interpolation with center point designation, set the center point address of the arc as the arc address.


End point address
(Address set with [Da.6])
Sub point
(Address set with [Da.7])
Start point address (Address before starting positioning)


End point address
(Address set with [Da.6])
Center point address
(Address set with [Da.7])
Start point address (Address before starting positioning)

<(1) Circular interpolation with sub point designation> <(2) Circular interpolation with center point designation>

When not carrying out circular interpolation control or 3-axis helical interpolation control, the value set in "[Da.7] Arc address" will be invalid.

## ■When "[Pr.1] Unit setting" is "mm"

The table below lists the control methods that require the setting of the arc address and shows the setting range.
(With any control method excluded from the table below, the arc address does not need to be set.)

| [Da.2] setting value | Value set with the engineering tool (μm) | Value set with a program[*1] ( × $10^{-1}$ μm) |
|---|---|---|
| ABS circular sub: 0DH<br>ABS circular right: 0FH<br>ABS circular left: 10H | • Set the address<br>-214748364.8 to 214748364.7[*2] | • Set the address<br>-2147483648 to 2147483647 |
| INC circular sub: 0EH<br>INC circular right: 11H<br>INC circular left: 12H | • Set the movement amount<br>-214748364.8 to 214748364.7[*2] | • Set the movement amount<br>-2147483648 to 2147483647[*2] |
| ABS helical sub: 20H<br>ABS helical right: 22H<br>ABS helical left: 24H | • Set the address<br>-214748364.8 to 214748364.7 | • Set the address<br>-2147483648 to 2147483647 |
| INC helical sub: 21H<br>INC helical right: 23H<br>INC helical left: 25H | • Set the movement amount<br>-214748364.8 to 214748364.7[*2] | • Set the movement amount<br>-2147483648 to 2147483647 |

*1 Set an integer because the program cannot handle fractions.
(The value will be converted properly within the system.)

*2 Note that the maximum radius that circular interpolation control is possible is 536870912 ( × $10^{-1}$ μm), although the setting value can be input within the range shown in the above table, as an arc address.

## ■When "[Pr.1] Unit setting" is "degree"

No control method requires the setting of the arc address by "degree".

## ■When "[Pr.1] Unit setting" is "pulse"

The table below lists the control methods that require the setting of the arc address and shows the setting range.
(With any control method excluded from the table below, the arc address does not need to be set.)

| [Da.2] setting value | Value set with the engineering tool (pulse) | Value set with a program (pulse) |
|---|---|---|
| ABS circular sub: 0DH<br>ABS circular right: 0FH<br>ABS circular left: 10H | • Set the address<br>-2147483648 to 2147483647[*1] | • Set the address<br>-2147483648 to 2147483647 |
| INC circular sub: 0EH<br>INC circular right: 11H<br>INC circular left: 12H | • Set the movement amount<br>-2147483648 to 2147483647[*1] | • Set the movement amount<br>-2147483648 to 2147483647[*1] |
| ABS helical sub: 20H<br>ABS helical right: 22H<br>ABS helical left: 24H | • Set the address<br>-2147483648 to 2147483647 | • Set the address<br>-2147483648 to 2147483647 |
| INC helical sub: 21H<br>INC helical right: 23H<br>INC helical left: 25H | • Set the movement amount<br>-2147483648 to 2147483647[*1] | • Set the movement amount<br>-2147483648 to 2147483647[*1] |

*1 Note that the maximum radius that circular interpolation control is possible is 536870912 (pulse), although the setting value can be input within the range shown in the above table, as an arc address.

### ■When "[Pr.1] Unit setting" is "inch"

The table below lists the control methods that require the setting of the arc address and shows the setting range.
(With any control method excluded from the table below, the arc address does not need to be set.)

| [Da.2] setting value | Value set with the engineering tool (inch) | Value set with a program[*1] ( × $10^{-5}$ inch) |
|---|---|---|
| ABS circular sub: 0DH<br>ABS circular right: 0FH<br>ABS circular left: 10H | • Set the address<br>-21474.83648 to 21474.83647[*2] | • Set the address<br>-2147483648 to 2147483647 |
| INC circular sub: 0EH<br>INC circular right: 11H<br>INC circular left: 12H | • Set the movement amount<br>-21474.83648 to 21474.83647[*2] | • Set the movement amount<br>-2147483648 to 2147483647[*2] |
| ABS helical sub: 20H<br>ABS helical right: 22H<br>ABS helical left: 24H | • Set the address<br>-21474.83648 to 21474.83647 | • Set the address<br>-2147483648 to 2147483647 |
| INC helical sub: 21H<br>INC helical right: 23H<br>INC helical left: 25H | • Set the movement amount<br>-21474.83648 to 21474.83647[*2] | • Set the movement amount<br>-2147483648 to 2147483647[*2] |

*1 Set an integer because the program cannot handle fractions.
(The value will be converted properly within the system.)

*2 Note that the maximum radius that circular interpolation control is possible is 536870912 ( × $10^{-5}$ inch), although the setting value can be input within the range shown in the above table, as an arc address.

## [Da.8] Command speed

Set the command speed for positioning.

- If the set command speed exceeds "[Pr.8] Speed limit value", positioning will be carried out at the speed limit value.
- If "-1" is set for the command speed, the current speed (speed set for previous positioning data No.) will be used for positioning control. Use the current speed for uniform speed control, etc. If "-1" is set for continuing positioning data, and the speed is changed, the following speed will also change.

Note that when starting positioning, if the "-1" speed is set for the positioning data that carries out positioning control first, the error "Command speed is not set" (error code: 1A12H) will occur, and the positioning will not start.
Refer to the following for details on the errors.

☞ Page 591 List of Error Codes

| [Pr.1] setting value | Value set with the engineering tool (unit) | Value set with a program (unit) |
|---|---|---|
| 0: mm | 0.01 to 20000000.00 (mm/min) | 1 to 2000000000 ( × $10^{-2}$ mm/min) |
| 1: inch | 0.001 to 2000000.000 (inch/min) | 1 to 2000000000 ( × $10^{-3}$ inch/min) |
| 2: degree | 0.001 to 2000000.000 (degree/min)[*1] | 1 to 2000000000 ( × $10^{-3}$ degree/min)[*2] |
| 3: pulse | 1 to 1000000000 (pulse/s) | 1 to 1000000000 (pulse/s) |

*1 The range of command speed when "[Pr.83] Speed control 10 × multiplier setting for degree axis" is valid: 0.01 to 20000000.00 (degree/min)

*2 The range of command speed when "[Pr.83] Speed control 10 × multiplier setting for degree axis" is valid: 1 to 2000000000 (× $10^{-2}$ degree/min)

## [Da.9] Dwell time/JUMP destination positioning data No.

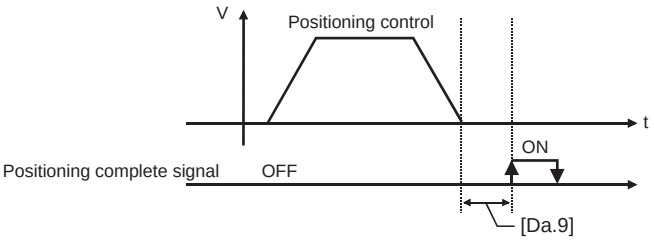
Set the "dwell time" or "positioning data No." corresponding to the "[Da.2] Control method".

- When a method other than "JUMP instruction" is set for "[Da.2] Control method": Set the "dwell time".
- When "JUMP instruction" is set for "[Da.2] Control method": Set the "positioning data No." for the JUMP destination.

When the "dwell time" is set, the setting details of the "dwell time" will be as follows according to "[Da.1] Operation pattern".

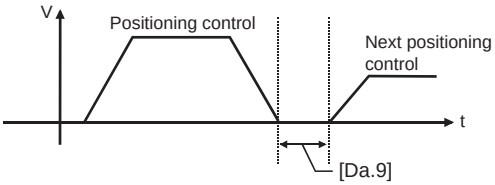
### ■When "[Da.1] Operation pattern" in "00: Positioning complete"

- Set the time from when the positioning ends to when the "positioning complete signal" turns ON as the "dwell time".



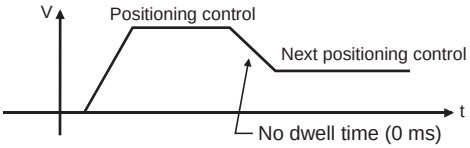

### ■When "[Da.1] Operation pattern" is "01: Continuous positioning control"

- Set the time from when positioning control ends to when the next positioning control starts as the "dwell time".




### ■When "[Da.1] Operation pattern" is "11: Continuous path control"

- The setting value is irrelevant to the control. (The "dwell time" is 0 ms.)




| [Da.2] setting value | Setting item | Value set with the engineering tool | Value set with a program |
|---|---|---|---|
| JUMP instruction: 82H | Positioning data No. | 1 to 600 | 1 to 600 |
| Other than JUMP instruction | Dwell time | 0 to 65535 (ms) | 0 to 65535 (ms) |

## [Da.10] M code/Condition data No./No. of LOOP to LEND repetitions/No. of pitches

Set an "M code", a "condition data No.", the "Number of LOOP to LEND repetitions" or the "Number of pitches" depending on how the "[Da.2] Control method" is set.[*1]

*1 The condition data specifies the condition for the JUMP instruction to be executed. (A JUMP will take place when the condition is satisfied.)

### ■If a method other than "JUMP instruction", "LOOP", and "3-axis helical interpolation control" is selected as the "[Da.2] Control method"

Set an "M code".

If no "M code" needs to be output, set "0" (default value).

### ■If "JUMP instruction" or "LOOP" is selected as the "[Da.2] Control method"

Set the "condition data No." for JUMP.

- 0: Unconditional JUMP to the positioning data specified by [Da.9].
- 1 to 10: JUMP performed according to the condition data No. specified (a number between 1 and 10). Make sure that you specify the number of LOOP to LEND repetitions by a number other than "0". The error "Control method LOOP setting error" (error code: 1A33H) will occur if you specify "0".

### ■If "3-axis helical interpolation control" is selected as the "[Da.2] Control method"

Set the number of pitches for the linear interpolation axis. The rotation speed of the circular interpolation is set with the number of pitch.

| [Da.2] setting value | Setting item | Value set with the engineering tool | Value set with a program |
|---|---|---|---|
| JUMP instruction: 82H | Condition data No. | 0 to 10 | 0 to 10 |
| Helical interpolation: 20H to 25H | Number of pitches | 0 to 999 | 0 to 999 |
| LOOP: 83H | Repetition count | 1 to 65535 | 1 to 65535 |
| Other than the above | M code | 0 to 65535 | 0 to 65535 |

## [Da.20] Axis to be interpolated No.1 to [Da.22] Axis to be interpolated No.3

Set the axis to be interpolated to execute the 2 to 4-axis interpolation operation. Set the circular interpolation axis and the linear interpolation axis to execute the 3-axis helical interpolation control.

| | |
|---|---|
| 2-axis interpolation | Set the target axis number in "[Da.20] Axis to be interpolated No.1". |
| 3-axis interpolation | Set the target axis number in "[Da.20] Axis to be interpolated No.1" and "[Da.21] Axis to be interpolated No.2". |
| 4-axis interpolation | Set the target axis number in "[Da.20] Axis to be interpolated No.1" to "[Da.22] Axis to be interpolated No.3". |
| 3-axis helical interpolation | Set the circular interpolation axis in "[Da.20] Axis to be interpolated No.1" and the linear interpolation axis number in "[Da.21] Axis to be interpolated No.2". |

Set the axis set as axis to be interpolated.

| | |
|---|---|
| 0: Axis 1 | 8: Axis 9 |
| 1: Axis 2 | 9: Axis 10 |
| 2: Axis 3 | A: Axis 11 |
| 3: Axis 4 | B: Axis 12 |
| 4: Axis 5 | C: Axis 13 |
| 5: Axis 6 | D: Axis 14 |
| 6: Axis 7 | E: Axis 15 |
| 7: Axis 8 | F: Axis 16 |

**Point**

- Do not specify the own axis number or the value outside the range. Otherwise, the error "Illegal interpolation description command" (error code: 1A22H) will occur during the program execution.
- When the same axis number or axis number of own axis is set to multiple axis to be interpolated number, the error "Illegal interpolation description command" (error code: 1A22H) will occur during the program execution.)
- Do not specify the axis to be interpolated No.2 and axis to be interpolated No.3 for 2-axis interpolation, and do not specify the axis to be interpolated No.3 for 3-axis interpolation. The setting value is ignored.

## [Da.27] M code ON signal output timing

Set the M code ON signal output timing to each positioning data.

Refer to the following for setting details.

☞ Page 421 [Pr.18] M code ON signal output timing

0: Uses the setting value of "[Pr.18] M code ON signal output timing".

1: WITH mode

2: AFTER mode

## [Da.28] ABS direction in degrees

Set "[Cd.40] ABS direction in degrees" to each positioning data.

Refer to the following for setting details.

☞ Page 422 [Pr.20] Interpolation speed designation method

0: Uses the setting value of "[Cd.40] ABS direction in degrees".

1: ABS circular right

2: ABS circular left

3: Takes a shortcut. (Specified direction ignored.)

## [Da.29] Interpolation speed designation method

Set the interpolation speed designation method to each positioning data.

Refer to the following for setting details.

☞ Page 422 [Pr.20] Interpolation speed designation method

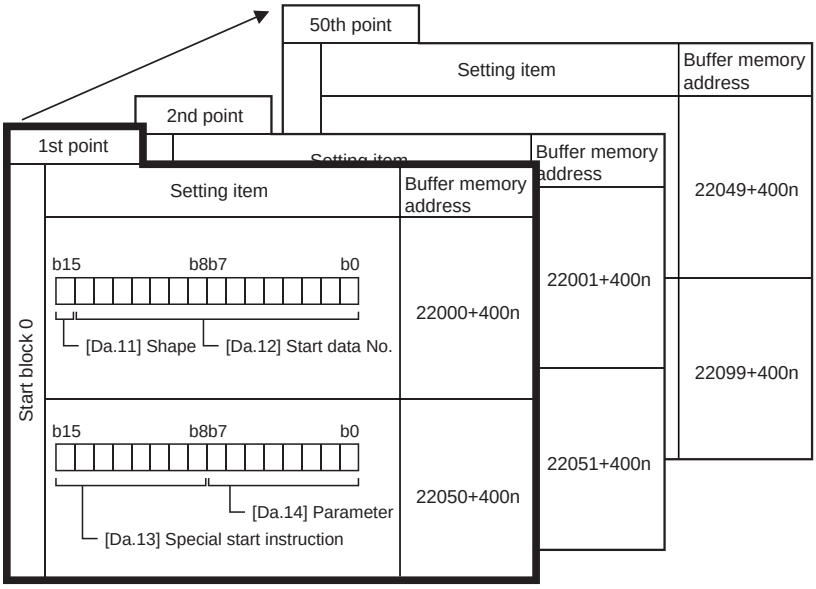
0: Uses the setting value of "[Pr.20] Interpolation speed designation method".

1: Composite speed

2: Reference axis speed

# 12.5 Block Start Data

Before explaining the block start data setting items [Da.11] to [Da.14], the configuration of the block start data is shown below.
The block start data stored in the buffer memory of the Simple Motion module is the following configuration.




- Up to 50 block start data points can be set (stored) for each axis in the buffer memory addresses shown on the left.
- Items in a single unit of block start data are shown included in a bold frame.
- Each axis has five start blocks (block Nos. 0 to 4).
  Start block 2 to 4 are not allocated to buffer memory.
  Set with the engineering tool.

n: Axis No. - 1

The following explains the block start data setting items [Da.11] to [Da.14]. (The buffer memory addresses shown are those of the "1st point block start data (block No.7000)".)

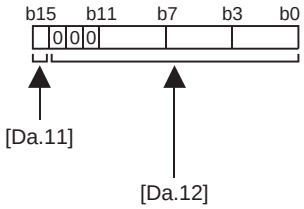
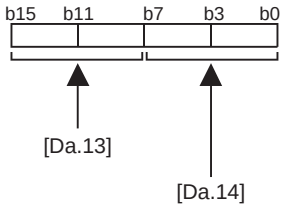
**Point**

- To perform a high-level positioning control using block start data, set a number between 7000 and 7004 to the "[Cd.3] Positioning start No." and use the "[Cd.4] Positioning starting point No." to specify a point number between 1 and 50, a position counted from the beginning of the block.
- The number between 7000 and 7004 specified here is called the "block No.".
- With the Simple Motion module, up to 50 "block start data" points and up to 10 "condition data" items can be assigned to each "block No.".

| Block No.*1 | Axis | Block start data | Condition | Buffer memory | Engineering tool |
|---|---|---|---|---|---|
| 7000 | Axis 1 | Start block 0 | Condition data (1 to 10) | Supports the settings | Supports the settings |
| | ⋮ | | ⋮ | | |
| | Axis 16 | | Condition data (1 to 10) | | |
| 7001 | Axis 1 | Start block 1 | Condition data (1 to 10) | | |
| | ⋮ | | ⋮ | | |
| | Axis 16 | | Condition data (1 to 10) | | |
| 7002 | Axis 1 | Start block 2 | Condition data (1 to 10) | — | |
| | ⋮ | | ⋮ | | |
| | Axis 16 | | Condition data (1 to 10) | | |
| 7003 | Axis 1 | Start block 3 | Condition data (1 to 10) | | |
| | ⋮ | | ⋮ | | |
| | Axis 16 | | Condition data (1 to 10) | | |
| 7004 | Axis 1 | Start block 4 | Condition data (1 to 10) | | |
| | ⋮ | | ⋮ | | |
| | Axis 16 | | Condition data (1 to 10) | | |

*1 Setting cannot be made when the "Pre-reading start function" is used. If you set any of Nos. 7000 to 7004 and perform the Pre-reading start function, the error "Outside start No. range" (error code: 19A3H)" will occur.
Refer to the following for details.
☞ Page 266 Pre-reading start function

n: Axis No. - 1

| Item | Setting value | | | Default value | Buffer memory address |
|---|---|---|---|---|---|
| | Value set with the engineering tool | Value set with a program | | | |
| [Da.11] Shape | 0: End | 0 |  | 0000H | 22000+400n |
| | 1: Continue | 1 | | | |
| [Da.12] Start data No. | Positioning data No: 1 to 600 (01H to 258H) | 01H to 258H | | | |
| [Da.13] Special start instruction | 0: Block start (normal start) | 00H |  | 0000H | 22050+400n |
| | 1: Condition start | 01H | | | |
| | 2: Wait start | 02H | | | |
| | 3: Simultaneous start | 03H | | | |
| | 4: FOR loop | 04H | | | |
| | 5: FOR condition | 05H | | | |
| | 6: NEXT start | 06H | | | |
| [Da.14] Parameter | Condition data No.: 1 to 10 (01H to 0AH)<br>Number of repetitions: 0 to 255 (00H to FFH) | 00H to FFH | | | |

## [Da.11] Shape

Set whether to carry out only the local "block start data" and then end control, or to execute the "block start data" set in the next point.

| Setting value | Setting details |
|---|---|
| 0: End | Execute the designated point's "block start data", and then complete the control. |
| 1: Continue | Execute the designated point's "block start data", and after completing control, execute the next point's "block start data". |

## [Da.12] Start data No.

Set the "positioning data No." designated with the "block start data".

## [Da.13] Special start instruction

Set the "special start instruction" for using "high-level positioning control". (Set how to start the positioning data set in "[Da.12] Start data No.".)

| Setting value | Setting details |
|---|---|
| 00H: Block start (Normal start) | Execute the random block positioning data in the set order with one start. |
| 01H: Condition start | Carry out the condition judgment set in "condition data" for the designated positioning data, and when the conditions are established, execute the "block start data". If not established, ignore that "block start data", and then execute the next point's "block start data". |
| 02H: Wait start | Carry out the condition judgment set in "condition data" for the designated positioning data, and when the conditions are established, execute the "block start data". If not established, stop the control (wait) until the conditions are established. |
| 03H: Simultaneous start | Simultaneous execute (output command at same timing) the positioning data with the No. designated for the axis designated in the "condition data". Up to four axes can start simultaneously. |
| 04H: Repeated start (FOR loop) | Repeat the program from the block start data with the "FOR loop" to the block start data with "NEXT" for the designated number of times. |
| 05H: Repeated start (FOR condition) | Repeat the program from the block start data with the "FOR condition" to the block start data with "NEXT" until the conditions set in the "condition data" are established. |
| 06H: NEXT start | Set the end of the repetition when "04H: Repetition start (FOR loop)" or "05H: Repetition start (FOR condition)" is set. |

Refer to the following for details on the control.

☞ Page 143 HIGH-LEVEL POSITIONING CONTROL

## [Da.14] Parameter

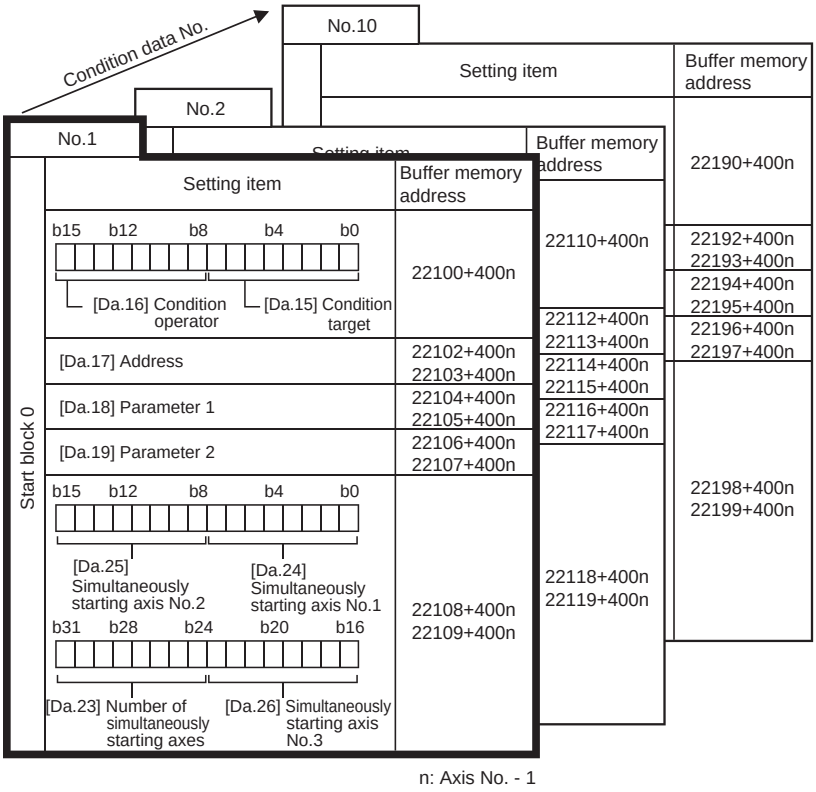
Set the value as required for "[Da.13] Special start instruction".

| [Da.13] Special start instruction | Setting value | Setting details |
|---|---|---|
| Block start (Normal start) | — | Not used. (There is no need to set.) |
| Condition start | 1 to 10 | Set the condition data No. (Data No. of "condition data" is set up for the condition judgment.) (Refer to ☞ Page 463 Condition Data for details on the condition data.) |
| Wait start | | |
| Simultaneous start | | |
| Repeated start (FOR loop) | 0 to 255 | Set the number of repetitions. |
| Repeated start (FOR condition) | 1 to 10 | Set the condition data No. (Data No. of "condition data" is set up for the condition judgment.) |

# 12.6 Condition Data

Before explaining the condition data setting items [Da.15] to [Da.19] and [Da.23] to [Da.26], the configuration of the condition data is shown below.

The condition data stored in the buffer memory of the Simple Motion module is the following configuration.




n: Axis No. - 1

- Up to 10 condition data points can be set (stored) for each block No. in the buffer memory addresses shown on the left.
- Items in a single unit of condition data are shown included in a bold frame.
- Each axis has five start blocks (block Nos. 0 to 4).
  Start block 2 to 4 are not allocated to buffer memory.
  Set with the engineering tool.

The following explains the condition data setting items [Da.15] to [Da.19] and [Da.23] to [Da.26]. (The buffer memory addresses shown are those of the "condition data No.1 (block No.7000)".)

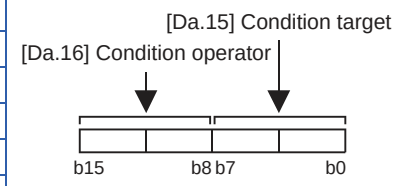
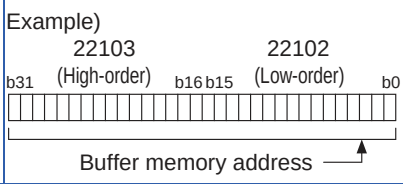
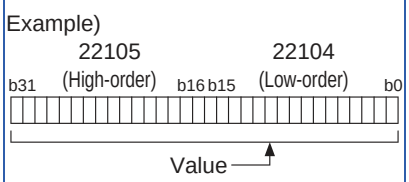
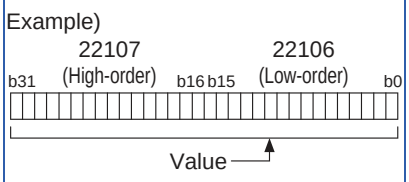
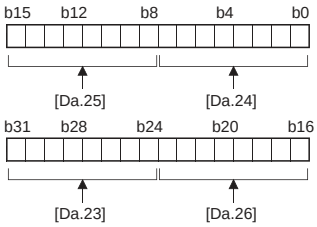
**Point**

- To perform a high-level positioning control using block start data, set a number between 7000 and 7004 to the "[Cd.3] Positioning start No." and use the "[Cd.4] Positioning starting point No." to specify a point number between 1 and 50, a position counted from the beginning of the block.
- The number between 7000 and 7004 specified here is called the "block No.".
- With the Simple Motion module, up to 50 "block start data" points and up to 10 "condition data" items can be assigned to each "block No.".

| Block No.*1 | Axis | Block start data | Condition | Buffer memory | Engineering tool |
|---|---|---|---|---|---|
| 7000 | Axis 1 | Start block 0 | Condition data (1 to 10) | Supports the settings | Supports the settings |
| | ⋮ | | ⋮ | | |
| | Axis 16 | | Condition data (1 to 10) | | |
| 7001 | Axis 1 | Start block 1 | Condition data (1 to 10) | | |
| | ⋮ | | ⋮ | | |
| | Axis 16 | | Condition data (1 to 10) | | |
| 7002 | Axis 1 | Start block 2 | Condition data (1 to 10) | — | |
| | ⋮ | | ⋮ | | |
| | Axis 16 | | Condition data (1 to 10) | | |
| 7003 | Axis 1 | Start block 3 | Condition data (1 to 10) | | |
| | ⋮ | | ⋮ | | |
| | Axis 16 | | Condition data (1 to 10) | | |
| 7004 | Axis 1 | Start block 4 | Condition data (1 to 10) | | |
| | ⋮ | | ⋮ | | |
| | Axis 16 | | Condition data (1 to 10) | | |

*1 Setting cannot be made when the "Pre-reading start function" is used. If you set any of Nos. 7000 to 7004 and perform the Pre-reading start function, the error "Outside start No. range" (error code: 19A3H) will occur.
Refer to the following for details.
☞ Page 266 Pre-reading start function

n: Axis No. - 1

| Item | | Setting value | | | Default value | Buffer memory address |
|---|---|---|---|---|---|---|
| | | Value set with the engineering tool | Value set with a program | | | |
| Condition identifier | [Da.15] Condition target | 01: Device X | 01H |  | 0000H | 22100+400n |
| | | 02: Device Y | 02H | | | |
| | | 03: Buffer memory (1-word) | 03H | | | |
| | | 04: Buffer memory (2-word) | 04H | | | |
| | | 05: Positioning data No. | 05H | | | |
| | [Da.16] Condition operator | 01: ** = P1 | 01H | | | |
| | | 02: ** ≠ P1 | 02H | | | |
| | | 03: ** ≤ P1 | 03H | | | |
| | | 04: ** ≥ P1 | 04H | | | |
| | | 05: P1 ≤ ** ≤ P2 | 05H | | | |
| | | 06: ** ≤ P1, P2 ≤ ** | 06H | | | |
| | | 07: DEV = ON | 07H | | | |
| | | 08: DEV = OFF | 08H | | | |
| [Da.17] Address | | Buffer memory address | |  | 0000H | 22102+400n<br>22103+400n |
| [Da.18] Parameter 1 | | Value | |  | 0000H | 22104+400n<br>22105+400n |
| [Da.19] Parameter 2 | | Value | |  | 0000H | 22106+400n<br>22107+400n |
| Simultaneously starting axis | [Da.23] Number of simultaneously starting axes | 2: 2 axes | 2H |  | 0000H | 22108+400n<br>22109+400n |
| | | 3: 3 axes | 3H | | | |
| | | 4: 4 axes | 4H | | | |
| | [Da.24] Simultaneously starting axis No.1 | 0: Axis 1 selected<br>1: Axis 2 selected<br>2: Axis 3 selected<br>3: Axis 4 selected<br>4: Axis 5 selected<br>5: Axis 6 selected<br>6: Axis 7 selected<br>7: Axis 8 selected<br>8: Axis 9 selected<br>9: Axis 10 selected<br>A: Axis 11 selected<br>B: Axis 12 selected<br>C: Axis 13 selected<br>D: Axis 14 selected<br>E: Axis 15 selected<br>F: Axis 16 selected | 0H<br>1H<br>2H<br>3H<br>4H<br>5H<br>6H<br>7H<br>8H<br>9H<br>AH<br>BH<br>CH<br>DH<br>EH<br>FH | | | |
| | [Da.25] Simultaneously starting axis No.2 | | | | | |
| | [Da.26] Simultaneously starting axis No.3 | | | | | |

## [Da.15] Condition target

Set the condition target as required for each control.

| Setting value | Setting details |
|---|---|
| 01H: Device X | Set the state (ON/OFF) of an I/O signal as a condition. |
| 02H: Device Y | |
| 03H: Buffer memory (1-word) | Set the value stored in the buffer memory as a condition.<br>03H: The target buffer memory is "1-word (16 bits)"<br>04H: The target buffer memory is "2-word (32 bits)" |
| 04H: Buffer memory (2-word) | |
| 05H: Positioning data No. | Select only for "simultaneous start". |

## [Da.16] Condition operator

Set the condition operator as required for the "[Da.15] Condition target".

| [Da.15] Condition target | Setting value | Setting details |
|---|---|---|
| 01H: Device X<br>02H: Device Y | 07H: DEV = ON | When the state (ON/OFF) of an I/O signal is set as a condition, select ON or OFF as the trigger. |
| | 08H: DEV = OFF | |
| 03H: Buffer memory (1-word)<br>04H: Buffer memory (2-word) | 01H: ** = P1 | Select how to use the value (**) in the buffer memory as a part of the condition. |
| | 02H: ** ≠ P1 | |
| | 03H: ** ≤ P1 | |
| | 04H: ** ≥ P1 | |
| | 05H: P1 ≤ ** ≤ P2 | |
| | 06H: ** ≤ P1, P2 ≤ ** | |

## [Da.17] Address

Set the address as required for the "[Da.15] Condition target".

| [Da.15] Condition target | Setting value | Setting details |
|---|---|---|
| 01H: Device X | — | Not used. (There is no need to set.) |
| 02H: Device Y | | |
| 03H: Buffer memory (1-word) | Value (Buffer memory address) | Set the target "buffer memory address". (For 2 words, set the low-order buffer memory address.) |
| 04H: Buffer memory (2-word) | | |
| 05H: Positioning data No. | — | Not used. (There is no need to set.) |

## [Da.18] Parameter 1

Set the parameters as required for the "[Da.16] Condition operator" and "[Da.23] Number of simultaneously starting axes".

| [Da.16] Condition operator | [Da.23] Number of simultaneously starting axes | Setting value | Setting details |
|---|---|---|---|
| 01H: ** = P1 | — | Value | The value of P1 should be equal to or smaller than the value of P2. (P1 ≤ P2)<br>If P1 is greater than P2 (P1 > P2), the error "Condition data error" (error code: 1A00H to 1A05H) will occur. |
| 02H: ** ≠ P1 | | | |
| 03H: ** ≤ P1 | | | |
| 04H: ** ≥ P1 | | | |
| 05H: P1 ≤ ** ≤ P2 | | | |
| 06H: ** ≤ P1, P2 ≤ ** | | | |
| 07H: DEV = ON | | | |
| 08H: DEV = OFF | | Value<br>(bit No.) | Set the device bit No.<br>X: 0H to 1H, 10H to 1FH, Y: 0H, 1H, 10H to 1FH |
| — | 2 to 4 | Value<br>(positioning data No.) | Set the positioning data No. for starting axis set in "[Da.24] Simultaneously starting axis No.1" and/or "[Da.25] Simultaneously starting axis No.2".<br>Low-order 16-bit: Simultaneously starting axis No.1 positioning data No.1 to 600 (01H to 258H)<br>High-order 16-bit: Simultaneously starting axis No.2 positioning data No.1 to 600 (01H to 258H) |

## [Da.19] Parameter 2

Set the parameters as required for the "[Da.16] Condition operator" and "[Da.23] Number of simultaneously starting axes".

| [Da.16] Condition operator | [Da.23] Number of simultaneously starting axes | Setting value | Setting details |
|---|---|---|---|
| 01H: ** = P1 | — | — | Not used. (No need to be set.) |
| 02H: ** ≠ P1 | | | |
| 03H: ** ≤ P1 | | | |
| 04H: ** ≥ P1 | | | |
| 05H: P1 ≤ ** ≤ P2 | | Value | The value of P2 should be equal to or greater than the value of P1. (P1 ≤ P2)<br>If P1 is greater than P2 (P1 > P2), the error "Condition data error" (error code: 1A00H to 1A05H) will occur. |
| 06H: ** ≤ P1, P2 ≤ ** | | | |
| 07H: DEV = ON | | — | Not used. (No need to be set.) |
| 08H: DEV = OFF | | | |
| — | 2 to 3 | | |
| | 4 | Value<br>(positioning data No.) | Set the positioning data No. for starting axis set in "[Da.26] Simultaneously starting axis No.3"<br>Low-order 16-bit: Simultaneously starting axis No.3 positioning data No. 1 to 600 (01H to 258H)<br>High-order 16-bit: Not used (Set "0") |

## [Da.23] Number of simultaneously starting axes

Set the number of simultaneously starting axes to execute the simultaneous start.

| Number of axes | Details |
|---|---|
| 2 | Simultaneous start by 2 axes of the starting axis and axis set in "[Da.24] Simultaneously starting axis No.1". |
| 3 | Simultaneous start by 3 axes of the starting axis and axis set in "[Da.24] Simultaneously starting axis No.1" and "[Da.25] Simultaneously starting axis No.2". |
| 4 | Simultaneous start by 4 axes of the starting axis and axis set in "[Da.24] Simultaneously starting axis No.1" to "[Da.26] Simultaneously starting axis No.3". |

## [Da.24] Simultaneously starting axis No.1 to [Da.26] Simultaneously starting axis No.3

Set the simultaneously starting axis to execute the 2 to 4-axis simultaneous start.

| Simultaneously starting axis | Details |
|---|---|
| 2-axis interpolation | Set the target axis number in "[Da.24] Simultaneously starting axis No.1". |
| 3-axis interpolation | Set the target axis number in "[Da.24] Simultaneously starting axis No.1" and "[Da.25] Simultaneously starting axis No.2". |
| 4-axis interpolation | Set the target axis number in "[Da.24] Simultaneously starting axis No.1" to "[Da.26] Simultaneously starting axis No.3". |

Set the axis set as simultaneously starting axis.

| | |
|---|---|
| 0: Axis 1 | 8: Axis 9 |
| 1: Axis 2 | 9: Axis 10 |
| 2: Axis 3 | A: Axis 11 |
| 3: Axis 4 | B: Axis 12 |
| 4: Axis 5 | C: Axis 13 |
| 5: Axis 6 | D: Axis 14 |
| 6: Axis 7 | E: Axis 15 |
| 7: Axis 8 | F: Axis 16 |

*1 Do not specify the own axis number or the value outside the range. Otherwise, the error "Condition data error" (error code: 1A00H to 1A05H) will occur during the program execution.

*2 When the same axis number or axis number of own axis is set to multiple simultaneously starting axis number, the error "Condition data error" (error code: 1A00H to 1A05H) will occur during the program execution.

*3 Do not specify the simultaneously starting axis No.2 and simultaneously starting axis No.3 for 2-axis simultaneously start, and not specify the simultaneously starting axis No.3 for 3-axis simultaneously start. The setting value is ignored.

# 12.7 Monitor Data

The setting items of the monitor data are explained in this section.

## System monitor data

Unless noted in particular, the monitor value is saved as binary data.

| Item | | Default value |
|---|---|---|
| Start history (Up to 64 records can be stored) | [Md.3] Start information | 0000H |
| | [Md.4] Start No. | 0000H |
| | [Md.54] Start (Year: month) | 0000H |
| | [Md.5] Start (Day: hour) | 0000H |
| | [Md.6] Start (Minute: second) | 0000H |
| | [Md.60] Start (ms) | 0000H |
| | [Md.7] Error judgment | 0000H |
| | [Md.8] Start history pointer | 0000H |
| [Md.19] Number of write accesses to flash ROM | | 0 |
| [Md.50] Forced stop input | | 0 |
| [Md.51] Amplifier-less operation mode status | | 0 |
| [Md.52] Communication between amplifiers axes searching flag | | 0 |
| [Md.53] SSCNET control status | | 0 |
| [Md.59] Module information | | RD77MS2: 4000H<br>RD77MS4: 4001H<br>RD77MS8: 4002H<br>RD77MS16: 4003H |
| [Md.130] F/W version | | Factory-set product information |
| [Md.131] Digital oscilloscope running flag | | 0 |
| [Md.132] Operation cycle setting | | 0 |
| [Md.133] Operation cycle over flag | | 0 |
| [Md.134] Operation time | | 0 |
| [Md.135] Maximum operation time | | 0 |

## [Md.3] Start information

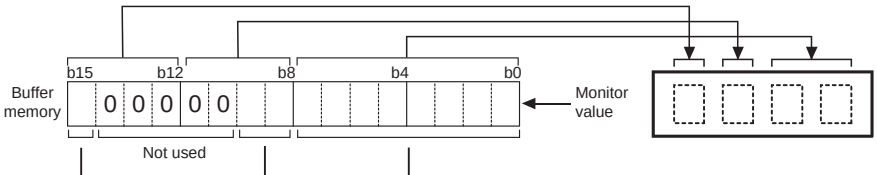
This area stores the start information (restart flag, start origin, and start axis):

- Restart flag: Indicates whether the operation has or has not been halted and restarted.
- Start origin: Indicates the source of the start signal.
- Start axis: Indicates the started axis.

Refresh cycle: At start

### ■Reading the monitor value

- Monitoring is carried out with a hexadecimal display.




● Start axis

| Stored contents | Stored value |
|---|---|
| Axis 1 | 1 |
| Axis 2 | 2 |
| Axis 3 | 3 |
| Axis 4 | 4 |
| Axis 5 | 5 |
| ⋮ | ⋮ |
| Axis 16 | 10 |

* Valid for the range from axis 1 to axis 2 in the RD77MS2, from axis 1 to axis 4 in the RD77MS4, and from axis 1 to axis 8 in the RD77MS8.

● Start origin

| Stored contents | Stored value |
|---|---|
| CPU module | 00 |
| External signal | 01 |
| Engineering tool | 10 |

● Restart flag

| Stored contents | Stored value |
|---|---|
| Restart flag OFF | 0 |
| Restart flag ON | 1 |

*1 If a start signal is issued against an operating axis, a record relating to this event may be output before a record relating to an earlier start signal is output.

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 390 Monitor data

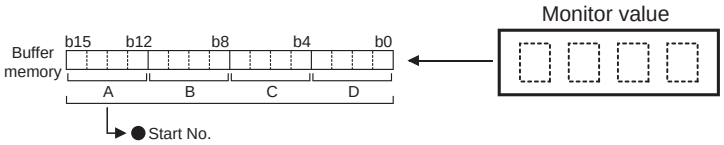
## [Md.4] Start No.

The start No. is stored.

Refresh cycle: At start

### ■Reading the monitor value

- Monitoring is carried out with a hexadecimal display.




| Stored contents | Storage value | | | | Reference (Decimal) |
|---|---|---|---|---|---|
| | A | B | C | D | |
| Positioning operation | 0 | 0 | 0 | 1 | 001 |
| | to | | | | to |
| | 0 | 2 | 5 | 8 | 600 |
| | 1 | B | 5 | 8 | 7000 |
| | 1 | B | 5 | 9 | 7001 |
| | 1 | B | 5 | A | 7002 |
| | 1 | B | 5 | B | 7003 |
| | 1 | B | 5 | C | 7004 |
| JOG operation | 2 | 3 | 3 | 2 | 9010 |
| Manual pulse generator | 2 | 3 | 3 | 3 | 9011 |
| Machine home position return | 2 | 3 | 2 | 9 | 9001 |
| Fast home position return | 2 | 3 | 2 | A | 9002 |
| Current value changing | 2 | 3 | 2 | B | 9003 |
| Simultaneous start | 2 | 3 | 2 | C | 9004 |
| Synchronous control operation | 2 | 3 | 3 | C | 9020 |
| Position control mode → speed control mode switching | 2 | 3 | 4 | 6 | 9030 |
| Position control mode → torque control mode switching | 2 | 3 | 4 | 7 | 9031 |
| Speed control mode → torque control mode switching | 2 | 3 | 4 | 8 | 9032 |
| Torque control mode → speed control mode switching | 2 | 3 | 4 | 9 | 9033 |
| Speed control mode → position control mode switching | 2 | 3 | 4 | A | 9034 |
| Torque control mode → position control mode switching | 2 | 3 | 4 | B | 9035 |
| Outside the range of control mode setting | 2 | 3 | 4 | C | 9036 |
| Position control mode → continuous operation to torque control mode switching | 2 | 3 | 4 | D | 9037 |
| Continuous operation to torque control mode → position control mode switching | 2 | 3 | 4 | E | 9038 |
| Speed control mode → continuous operation to torque control mode switching | 2 | 3 | 4 | F | 9039 |
| Continuous operation to torque control mode → speed control mode switching | 2 | 3 | 5 | 0 | 9040 |
| Torque control mode → continuous operation to torque control mode switching | 2 | 3 | 5 | 1 | 9041 |
| Continuous operation to torque control mode → torque control mode switching | 2 | 3 | 5 | 2 | 9042 |

*1 If a start signal is issued against an operating axis, a record relating to this event may be output before a record relating to an earlier start signal is output.

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 390 Monitor data

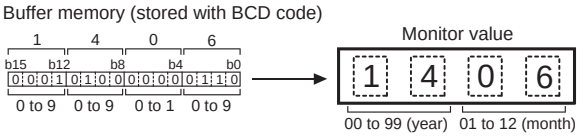
## [Md.54] Start (Year: month)

The starting time (Year: month) is stored.

Refresh cycle: At start

### ■Reading the monitor value

- Monitoring is carried out with a hexadecimal display.


Buffer memory (stored with BCD code)
1 4 0 6
b15 b12 b8 b4 b0
0 0 0 1 0 1 0 0 0 0 0 0 0 1 1 0
0 to 9 0 to 9 0 to 1 0 to 9
Monitor value
1 4 0 6
00 to 99 (year) 01 to 12 (month)

*1 If a start signal is issued against an operating axis, a record relating to this event may be output before a record relating to an earlier start signal is output.

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 390 Monitor data

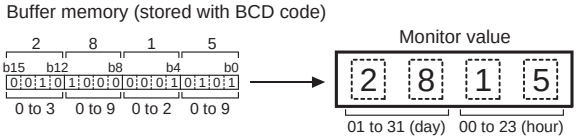
## [Md.5] Start (Day: hour)

The starting time (Day: hour) is stored.

Refresh cycle: At start

### ■Reading the monitor value

- Monitoring is carried out with a hexadecimal display.


Buffer memory (stored with BCD code)
2 8 1 5
b15 b12 b8 b4 b0
0 0 1 0 1 0 0 0 0 0 0 1 0 1 0 1
0 to 3 0 to 9 0 to 2 0 to 9
Monitor value
2 8 1 5
01 to 31 (day) 00 to 23 (hour)

*1 If a start signal is issued against an operating axis, a record relating to this event may be output before a record relating to an earlier start signal is output.

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 390 Monitor data

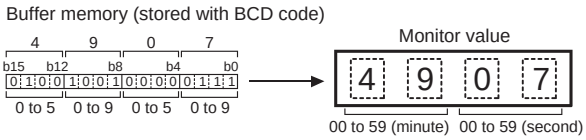
## [Md.6] Start (Minute: second)

The starting time (Minute: second) is stored.

Refresh cycle: At start

### ■Reading the monitor value

- Monitoring is carried out with a hexadecimal display.


Buffer memory (stored with BCD code)
4 9 0 7
b15 b12 b8 b4 b0
0 1 0 0 1 0 0 1 0 0 0 0 0 1 1 1
0 to 5 0 to 9 0 to 5 0 to 9
Monitor value
4 9 0 7
00 to 59 (minute) 00 to 59 (second)

*1 If a start signal is issued against an operating axis, a record relating to this event may be output before a record relating to an earlier start signal is output.

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 390 Monitor data

## [Md.60] Start (ms)

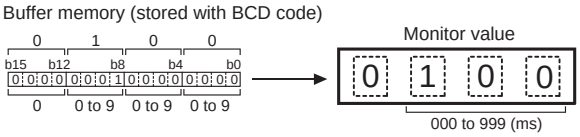
The starting time (ms) is stored.

000 (ms) to 999 (ms)

Refresh cycle: At start

### ■Reading the monitor value

- Monitoring is carried out with a hexadecimal display.


Buffer memory (stored with BCD code)
0 1 0 0
b15 b12 b8 b4 b0
0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0
0 0 to 9 0 to 9 0 to 9
Monitor value
0 1 0 0
000 to 999 (ms)

*1 If a start signal is issued against an operating axis, a record relating to this event may be output before a record relating to an earlier start signal is output.

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 390 Monitor data

## [Md.7] Error judgment

This area stores the following results of the error judgment performed upon starting:

- Warning flag

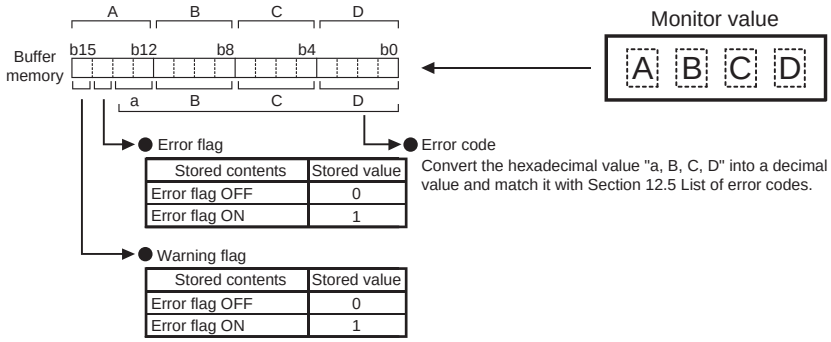
| |
|---|
| BUSY start |
| Control mode switching during BUSY |
| Control mode switching during zero speed OFF |
| Outside control mode range |
| Control mode switching |

- Error flag
- Error code

Refresh cycle: At start

### ■Reading the monitor value

- Monitoring is carried out with a hexadecimal display.


A B C D
Buffer memory
b15 b12 b8 b4 b0
a B C D
Monitor value
A B C D
Error flag
Error code
Convert the hexadecimal value "a, B, C, D" into a decimal value and match it with Section 12.5 List of error codes.
Warning flag

| Stored contents | Stored value |
|---|---|
| Error flag OFF | 0 |
| Error flag ON | 1 |

| Stored contents | Stored value |
|---|---|
| Error flag OFF | 0 |
| Error flag ON | 1 |

*1 If a start signal is issued against an operating axis, a record relating to this event may be output before a record relating to an earlier start signal is output.

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 390 Monitor data

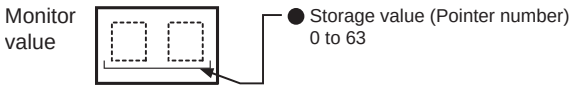
## [Md.8] Start history pointer

Indicates a pointer No. that is next to the pointer No. assigned to the latest of the existing start history records.

Refresh cycle: At start

### ■Reading the monitor value

- Monitoring is carried out with a decimal display.




*1 If a start signal is issued against an operating axis, a record relating to this event may be output before a record relating to an earlier start signal is output.

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 390 Monitor data

## [Md.19] Number of write accesses to flash ROM

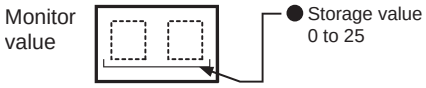
Stores the number of write accesses to the flash ROM after the power is switched ON.

The count is cleared to "0" when the number of write accesses reaches 26 and an error reset operation is performed.

Refresh cycle: Immediate

### ■Reading the monitor value

- Monitoring is carried out with a decimal display.




- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 390 Monitor data

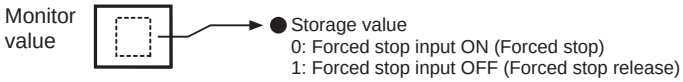
## [Md.50] Forced stop input

This area stores the states (ON/OFF) of forced stop input.

Refresh cycle: Operation cycle

### ■Reading the monitor value

- Monitoring is carried out with a decimal display.




- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 390 Monitor data

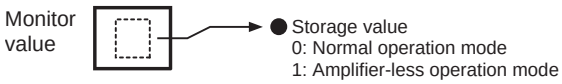
## [Md.51] Amplifier-less operation mode status

Indicates a current operation mode.

Refresh cycle: Immediate

### ■Reading the monitor value

- Monitoring is carried out with a decimal display.




- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 390 Monitor data

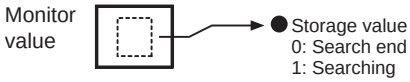
## [Md.52] Communication between amplifiers axes searching flag

Stores the detection status of axis that set communication between amplifiers.

Refresh cycle: Immediate

### ■Reading the monitor value

- Monitoring is carried out with a decimal display.




- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 390 Monitor data

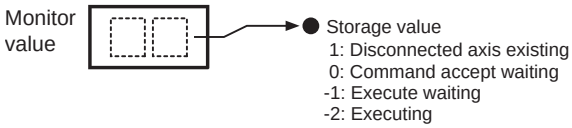
## [Md.53] SSCNET control status

Stores the connect/disconnect status of SSCNET communication.

Refresh cycle: Immediate

### ■Reading the monitor value

- Monitoring is carried out with a decimal display.




- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 390 Monitor data

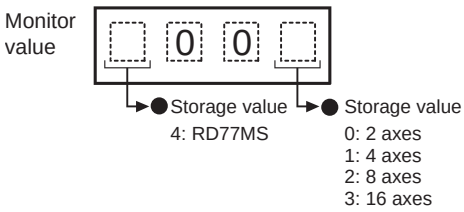
## [Md.59] Module information

Stores the module information.

Refresh cycle: At power supply ON

### ■Reading the monitor value

- Monitoring is carried out with a hexadecimal display.




- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 390 Monitor data

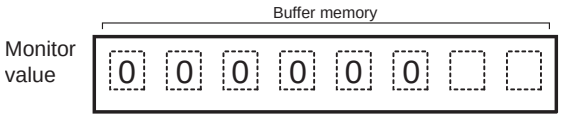
## [Md.130] F/W version

Stores the first two digits of the module product information.

Refresh cycle: At power supply ON

### ■Reading the monitor value

- Monitoring is carried out with a hexadecimal display.




- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 390 Monitor data

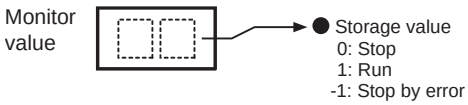
## [Md.131] Digital oscilloscope running flag

Stores the RUN status of digital oscilloscope.

Refresh cycle: Main cycle

### ■Reading the monitor value

- Monitoring is carried out with a decimal display.




- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 390 Monitor data

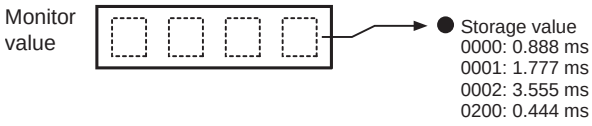
## [Md.132] Operation cycle setting

Stores the current operation cycle.

Refresh cycle: At power supply ON

### ■Reading the monitor value

- Monitoring is carried out with a hexadecimal display.




- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 390 Monitor data

## [Md.133] Operation cycle over flag

This flag turns ON when the operation cycle time exceeds operation cycle.

Refresh cycle: Immediate

### ■Reading the monitor value

- Monitoring is carried out with a decimal display.

**Point**

Latch status of operation cycle over is indicated. When this flag turns ON, correct the positioning detail or change the operation cycle longer than current setting.

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 390 Monitor data

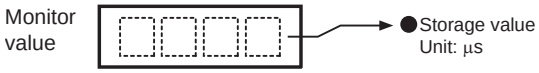
## [Md.134] Operation time

Stores the time that took for operation every operation cycle.

Refresh cycle: Operation cycle

### ■Reading the monitor value

- Monitoring is carried out with a decimal display.




- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 390 Monitor data

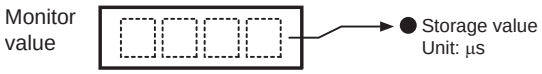
## [Md.135] Maximum operation time

Stores the maximum value of operation time after each module's power supply ON.

Refresh cycle: Immediate

### ■Reading the monitor value

- Monitoring is carried out with a decimal display.




- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 390 Monitor data

# Axis monitor data

| Item | Default value |
|---|---|
| [Md.20] Current feed value | 0000H |
| [Md.21] Machine feed value | 0000H |
| [Md.22] Feedrate | 0000H |
| [Md.23] Axis error No. | 0 |
| [Md.24] Axis warning No. | 0 |
| [Md.25] Valid M code | 0 |
| [Md.26] Axis operation status | 0 |
| [Md.27] Current speed | 0 |
| [Md.28] Axis feedrate | 0000H |
| [Md.29] Speed-position switching control positioning movement amount | 0000H |
| [Md.30] External input signal | 0000H |
| [Md.31] Status | 0008H |
| [Md.32] Target value | 0 |
| [Md.33] Target speed | 0000H |
| [Md.34] Movement amount after near-point dog ON | 0000H |
| [Md.35] Torque limit stored value/forward torque limit stored value | 0 |
| [Md.36] Special start data instruction code setting value | 0 |
| [Md.37] Special start data instruction parameter setting value | 0 |
| [Md.38] Start positioning data No. setting value | 0 |
| [Md.39] In speed limit flag | 0 |
| [Md.40] In speed change processing flag | 0 |
| [Md.41] Special start repetition counter | 0 |
| [Md.42] Control system repetition counter | 0000H |
| [Md.43] Start data pointer being executed | 0 |
| [Md.44] Positioning data No. being executed | 0 |
| [Md.45] Block No. being executed | 0 |
| [Md.46] Last executed positioning data No. | 0 |
| [Md.47] Positioning data being executed | 0 |
| [Md.48] Deceleration start flag | 0 |
| [Md.62] Amount of the manual pulser driving carrying over movement | 0 |
| [Md.100] Home position return re-travel value | 0000H |
| [Md.101] Real current value | 0000H |
| [Md.102] Deviation counter value | 0000H |
| [Md.103] Motor rotation speed | 0000H |
| [Md.104] Motor current value | 0 |
| [Md.106] Servo amplifier software No. | 0 |
| [Md.107] Parameter error No. | 0 |
| [Md.108] Servo status1 | 0000H |
| [Md.109] Regenerative load ratio/Optional data monitor output 1 | 0 |
| [Md.110] Effective load torque/Optional data monitor output 2 | 0 |
| [Md.111] Peak torque ratio/Optional data monitor output 3 | 0 |
| [Md.112] Optional data monitor output 4 | 0 |
| [Md.113] Semi/Fully closed loop status | 0 |
| [Md.114] Servo alarm | 0000H |
| [Md.116] Encoder option information | 0000H |
| [Md.119] Servo status2 | 0000H |
| [Md.120] Reverse torque limit stored value | 0 |
| [Md.122] Speed during command | 0 |
| [Md.123] Torque during command | 0 |

| Item | Default value |
|---|---|
| [Md.124] Control mode switching status | 0 |
| [Md.125] Servo status3 | 0000H |
| [Md.500] Servo status7 | 0000H |
| [Md.502] Driver operation alarm number | 0000H |
| [Md.503] Pre-reading data analysis status | 0 |

## [Md.20] Current feed value

The currently commanded address is stored. (Different from the actual motor position during operation)

The current position address is stored.

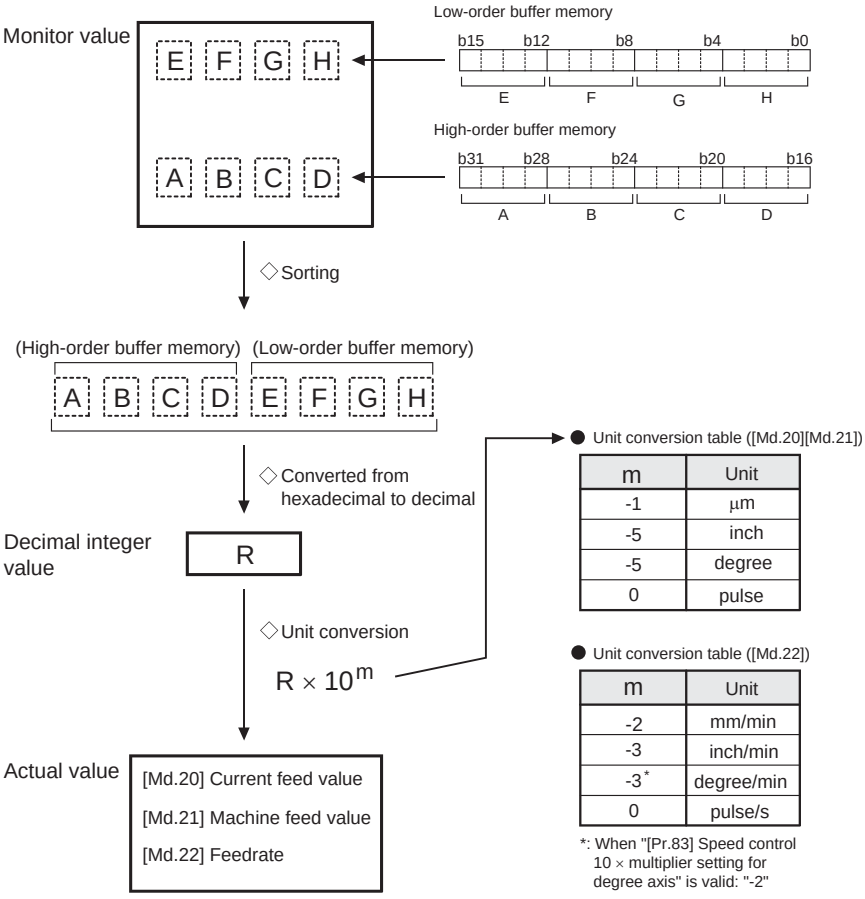
If "degree" is selected as the unit, the addresses will have a ring structure for values between 0 and 359.99999°.

- The home position address is stored when the machine home position return is completed.
- When the current value is changed with the current value changing function, the changed value is stored.

Refresh cycle: Operation cycle

### ■Reading the monitor value

- Monitoring is carried out with a hexadecimal.




● Unit conversion table ([Md.20][Md.21])

| m | Unit |
|---|---|
| -1 | μm |
| -5 | inch |
| -5 | degree |
| 0 | pulse |

● Unit conversion table ([Md.22])

| m | Unit |
|---|---|
| -2 | mm/min |
| -3 | inch/min |
| -3* | degree/min |
| 0 | pulse/s |

*: When "[Pr.83] Speed control 10 × multiplier setting for degree axis" is valid: "-2"

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 390 Monitor data

## [Md.21] Machine feed value

The address of the current position according to the machine coordinates will be stored. (Different from the actual motor position during operation)

Note that the current value changing function will not change the machine feed value.

Under the speed control mode, the machine feed value is constantly updated always, irrespective of the parameter setting.

The value will not be cleared to "0" at the beginning of fixed-feed control.

Even if "degree" is selected as the unit, the addresses will become a cumulative value. (They will not have a ring structure for values between 0 and 359.99999°). However, the machine feed value is restored within the range of 0 to 359.99999° at the communication start with servo amplifier after the power supply ON or CPU module reset.

- Machine coordinates: Characteristic coordinates determined with machine

Refresh cycle: Operation cycle

### ■Reading the monitor value

Refer to "[Md.20] Current feed value".

☞ Page 478 [Md.20] Current feed value

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 390 Monitor data

## [Md.22] Feedrate

The speed of the operating workpiece is stored. (May be different from the actual motor speed during operation)

- During interpolation operation, the speed is stored in the following manner.

| | |
|---|---|
| Reference axis | Composite speed or reference axis speed (Set with [Pr.20]) |
| Interpolation axis | 0 |

Refresh cycle: Operation cycle

**Point**

In case of the single axis operation, "[Md.22] Feedrate" and "[Md.28] Axis feedrate" are identical.

In the composite mode of the interpolation operation, "[Md.22] Feedrate" is a speed in a composite direction and "[Md.28] Axis feedrate" is that in each axial direction.

### ■Reading the monitor value

Refer to "[Md.20] Current feed value".

☞ Page 478 [Md.20] Current feed value

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 390 Monitor data

## [Md.23] Axis error No.

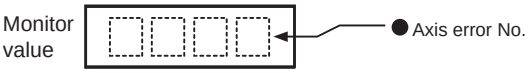
When an axis error is detected, the error code corresponding to the error details is stored.

- The latest error code is always stored. (When a new axis error occurs, the error code is overwritten.)
- When "[Cd.5] Axis error reset" (axis control data) turns ON, the axis error No. is cleared (set to 0).

Refresh cycle: Immediate

### ■Reading the monitor value

- Monitoring is carried out with a hexadecimal display.




- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 390 Monitor data

## [Md.24] Axis warning No.

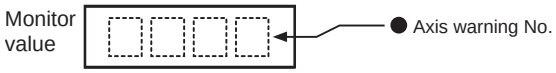
Whenever an axis warning is reported, a related warning code is stored.

- This area stores the latest warning code always. (Whenever an axis warning is reported, a new warning code replaces the stored warning code.)
- When the "[Cd.5] Axis error reset" (axis control data) is set to ON, the axis warning No. is cleared to "0".

Refresh cycle: Immediate

### ■Reading the monitor value

- Monitoring is carried out with a hexadecimal display.




- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 390 Monitor data

## [Md.25] Valid M code

This area stores an M code that is currently active (i.e. set to the positioning data relating to the current operation).

When the PLC READY signal [Y0] is OFF, the value is set to "0".

Refresh cycle: Immediate

### ■Reading the monitor value

- Monitoring is carried out with a decimal display.

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 390 Monitor data

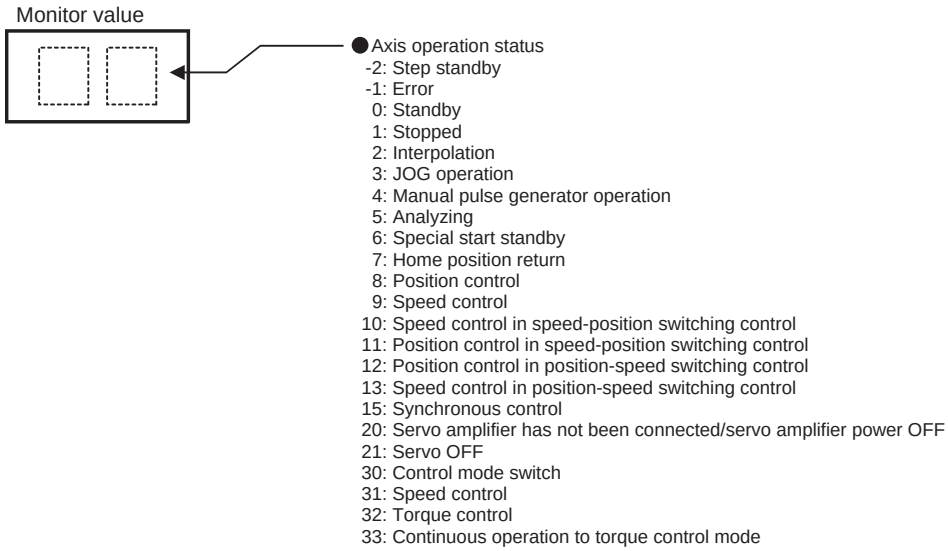
## [Md.26] Axis operation status

This area stores the axis operation status.

Refresh cycle: Immediate

### ■Reading the monitor value

- Monitoring is carried out with a decimal display.


Monitor value
Axis operation status
-2: Step standby
-1: Error
0: Standby
1: Stopped
2: Interpolation
3: JOG operation
4: Manual pulse generator operation
5: Analyzing
6: Special start standby
7: Home position return
8: Position control
9: Speed control
10: Speed control in speed-position switching control
11: Position control in speed-position switching control
12: Position control in position-speed switching control
13: Speed control in position-speed switching control
15: Synchronous control
20: Servo amplifier has not been connected/servo amplifier power OFF
21: Servo OFF
30: Control mode switch
31: Speed control
32: Torque control
33: Continuous operation to torque control mode

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 390 Monitor data

## [Md.27] Current speed

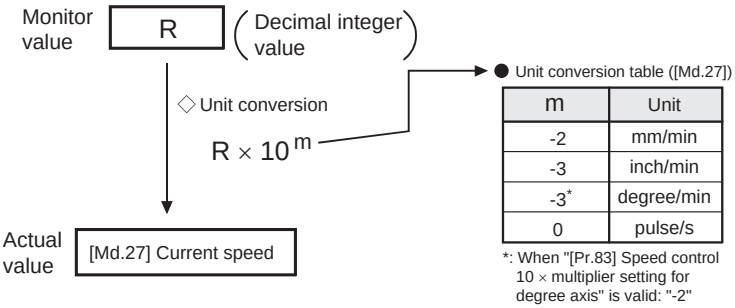
The "[Da.8] Command speed" used by the positioning data currently being executed is stored.

- If "[Da.8] Command speed" is set to "-1", this area stores the command speed set by the positioning data used one step earlier.
- If "[Da.8] Command speed" is set to a value other than "-1", this area stores the command speed set by the current positioning data.
- When speed change function is executed, this area stores "[Cd.14] New speed value". (For details of change speed function, refer to ☞ Page 248 Speed change function)

Refresh cycle: Immediate

### ■Reading the monitor value

- Monitor is carried out with a decimal display.




| m | Unit |
|---|---|
| -2 | mm/min |
| -3 | inch/min |
| -3* | degree/min |
| 0 | pulse/s |

*: When "[Pr.83] Speed control 10 × multiplier setting for degree axis" is valid: "-2"

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 390 Monitor data

## [Md.28] Axis feedrate

- The speed which is actually output as a command at that time in each axis is stored. (May be different from the actual motor speed)"0" is stored when the axis is at a stop. (☞ Page 479 [Md.22] Feedrate)

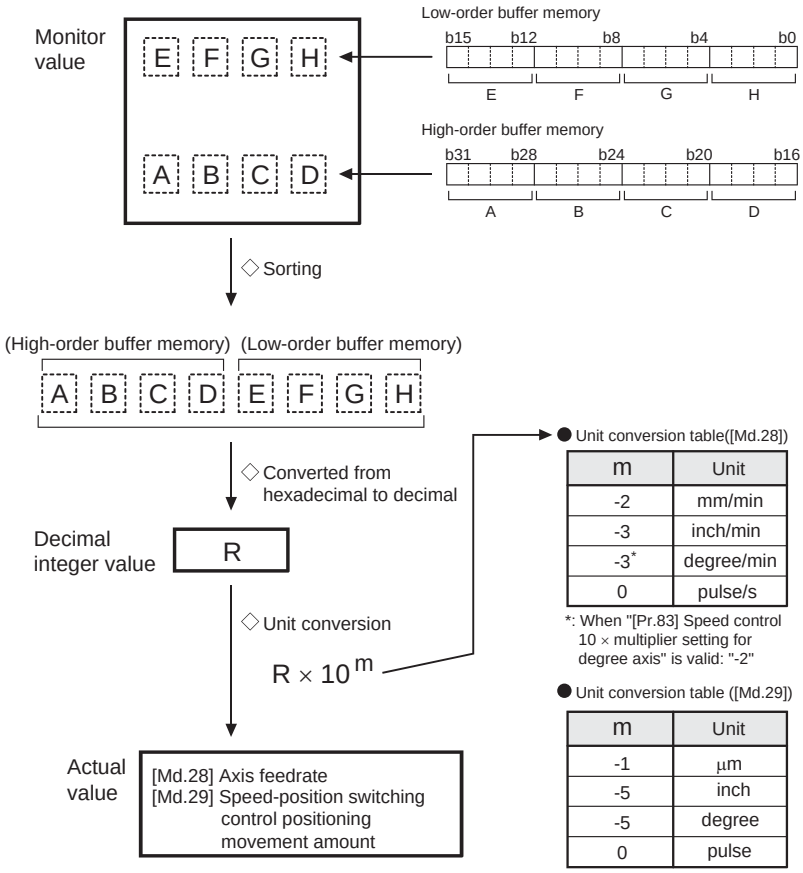
Refresh cycle: Operation cycle

### ■Reading the monitor value

Refer to the following.

☞ Page 478 [Md.20] Current feed value

- Monitoring is carried out with a hexadecimal.




● Unit conversion table([Md.28])

| m | Unit |
|---|---|
| -2 | mm/min |
| -3 | inch/min |
| -3* | degree/min |
| 0 | pulse/s |

*: When "[Pr.83] Speed control 10 × multiplier setting for degree axis" is valid: "-2"

● Unit conversion table ([Md.29])

| m | Unit |
|---|---|
| -1 | μm |
| -5 | inch |
| -5 | degree |
| 0 | pulse |

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 390 Monitor data

## [Md.29] Speed-position switching control positioning movement amount

- The movement amount for the position control to end after changing to position control with the speed-position switching control is stored. When the control method is "Reverse run: position/speed", the negative value is stored.

Refresh cycle: Immediate

### ■Reading the monitor value

Refer to "[Md.28] Axis feedrate".

☞ Page 482 [Md.28] Axis feedrate

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 390 Monitor data

## [Md.30] External input signal

The ON/OFF state of the external input signal is stored.

The following items are stored.

- Lower limit signal*1
- Upper limit signal*1
- Stop signal*1
- External command signal/switching signal
- Near-point dog signal*1

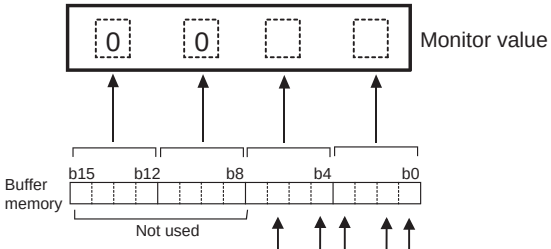
*1 This area stores the states of the external input signal (Simple Motion module), external input signal (servo amplifier) or buffer memory of Simple Motion module set by "[Pr.116] FLS signal selection", "[Pr.117] RLS signal selection", "[Pr.118] DOG signal selection", and "[Pr.119] STOP signal selection".

Refresh cycle: Operation cycle



### ■Reading the monitor value

- Monitoring is carried out with a hexadecimal.




| | Stored items | Default value | Meaning |
|---|---|---|---|
| b0 | Lower limit signal | 0 | 0: OFF<br>1: ON |
| b1 | Upper limit signal | 0 | |
| b2 | Not used | 0 | |
| b3 | Stop signal | 0 | |
| b4 | External command signal/switching signal | 0 | |
| b5 | Not used | 0 | |
| b6 | Near-point dog signal | 0 | |
| b7 | Not used | 0 | |

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 390 Monitor data

## [Md.31] Status

This area stores the states (ON/OFF) of various flags.

Information on the following flags is stored.

### ■In speed control flag

This signal that comes ON under the speed control can be used to judge whether the operation is performed under the speed control or position control. The signal goes OFF when the power is switched ON, under the position control, and during JOG operation or manual pulse generator operation. During the speed-position or position-speed switching control, this signal comes ON only when the speed control is in effect. During the speed-position switching control, this signal goes OFF when the speed-position switching signal executes a switching over from speed control to position control. During the position-speed switching control, this signal comes ON when the position-speed switching signal executes a switching over from position control to speed control.

### ■Speed-position switching latch flag

This signal is used during the speed-position switching control for interlocking the movement amount change function. During the speed-position switching control, this signal comes ON when position control takes over. This signal goes OFF when the next positioning data is processed, and during JOG operation or manual pulse generator operation.

### ■Command in-position flag

This signal is ON when the remaining distance is equal to or less than the command in-position range (set by a detailed parameter). This signal remains OFF with data that specify the continuous path control (P11) as the operation pattern. The state of this signal is monitored every operation cycle except when the monitoring is canceled under the speed control or while the speed control is in effect during the speed-position or position-speed switching control. While operations are performed with interpolation, this signal comes ON only in respect of the starting axis. (This signal goes OFF in respect of all axes upon starting.)

### ■Home position return request flag

This signal comes ON when the power is switched ON, when the absolute system has not been set, when the machine home position return has not been executed at the absolute position system, when a machine home position return operation starts. This signal goes OFF when a machine home position return operation completes.

(For details of home position return request flag, refer to ☞ Page 31 Outline of Home Position Return Control.)

### ■Home position return complete flag

This signal comes ON when a machine home position return operation completes normally. This signal goes OFF when the operation start.

### ■Position-speed switching latch flag

This signal is used during the position-speed switching control for interlocking the command speed change function. During the position-speed switching control, this signal comes ON when speed control takes over. This signal goes OFF when the next positioning data is processed, and during JOG operation or manual pulse generator operation.

### ■Axis warning detection flag

This signal comes On when an axis warning is reported and goes OFF when the axis error reset signal comes ON.

### ■Speed change 0 flag

This signal comes ON when the speed is "0" by the speed change or override. Otherwise, it goes OFF.

### ■M code ON

In the WITH mode, this signal turns ON when the positioning data operation is started. In the AFTER mode, this signal turns ON when the positioning data operation is completed.

This signal turns OFF with the "[Cd.7] M code OFF request".

When M code is not designated (when "[Da.10] M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches" is "0"), this signal will remain OFF.

With using continuous path control for the positioning operation, the positioning will continue even when this signal does not turn OFF.

However, the warning "M code ON signal ON" (warning code: 0992H) will occur.

When the PLC READY signal [Y0] turns OFF, the M code ON signal will also turn OFF.

If operation is started while the M code is ON, the error "M code ON signal start" (error code: 19A0H) will occur.

### ■Error detection

This signal turns ON when an error (☞ Page 591 List of Error Codes), and turns OFF when the error is reset on "[Cd.5] Axis error reset".

### ■Start complete

This signal turns ON when the positioning start signal turns ON and the Simple Motion module starts the positioning process. (The start complete signal also turns ON during home position return control.)

## ■Positioning complete

This signal turns ON for the time set in "[Pr.40] Positioning complete signal output time" from the instant when the positioning control for each positioning data No. is completed.

For the interpolation control, the positioning complete signal of interpolation axis turns ON during the time set to the reference axis.

(It does not turn ON when "[Pr.40] Positioning complete signal output time" is "0".)

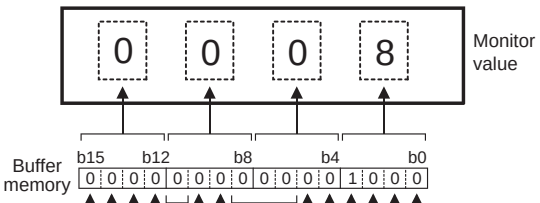
If positioning (including home position return), JOG/Inching operation, or manual pulse generator operation is started while this signal is ON, the signal will turn OFF.

This signal will not turn ON when speed control or positioning is canceled midway.

Refresh cycle: Immediate

## ■Reading the monitor value

- Monitoring is carried out with a hexadecimal display.




| | Stored items | Default value | Meaning |
|---|---|---|---|
| b0 | In speed control flag | 0 | 0: OFF<br>1: ON |
| b1 | Speed-position switching latch flag | 0 | |
| b2 | Command in-position flag | 0 | |
| b3 | Home position return request flag | 1 | |
| b4 | Home position return complete flag | 0 | |
| b5 | Position-speed switching latch flag | 0 | |
| b9 | Axis warning detection | 0 | |
| b10 | Speed change 0 flag | 0 | |
| b12 | M code ON | 0 | |
| b13 | Error detection | 0 | |
| b14 | Start complete | 0 | |
| b15 | Positioning complete | 0 | |

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 390 Monitor data

# [Md.32] Target value

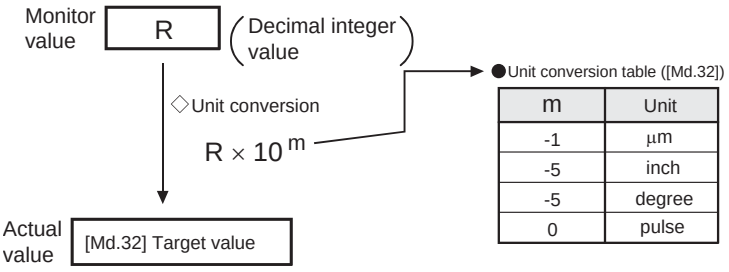
This area stores the target value ([Da.6] Positioning address/movement amount) for a positioning operation.

- At the beginning of positioning control and current value changing: Stores the value of "[Da.6] Positioning address/movement amount".
- At the home position shift operation of home position return control: Stores the value of home position shift amount.
- At other times: Stores "0".

Refresh cycle: Immediate

## ■Reading the monitor value

- Monitoring is carried out with a decimal display.




| m | Unit |
|---|---|
| -1 | μm |
| -5 | inch |
| -5 | degree |
| 0 | pulse |

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 390 Monitor data

## [Md.33] Target speed

- During operation with positioning data: The actual target speed, considering the override and speed limit value, etc., is stored. "0" is stored when positioning is completed.
- During interpolation of position control: The composite speed or reference axis speed is stored in the reference axis address, and "0" is stored in the interpolation axis address.
- During interpolation of speed control: The target speeds of each axis are stored in the monitor of the reference axis and interpolation axis.
- During JOG operation: The actual target speed, considering the JOG speed limit value for the JOG speed, is stored.
- During manual pulse generator operation: "0" is stored.

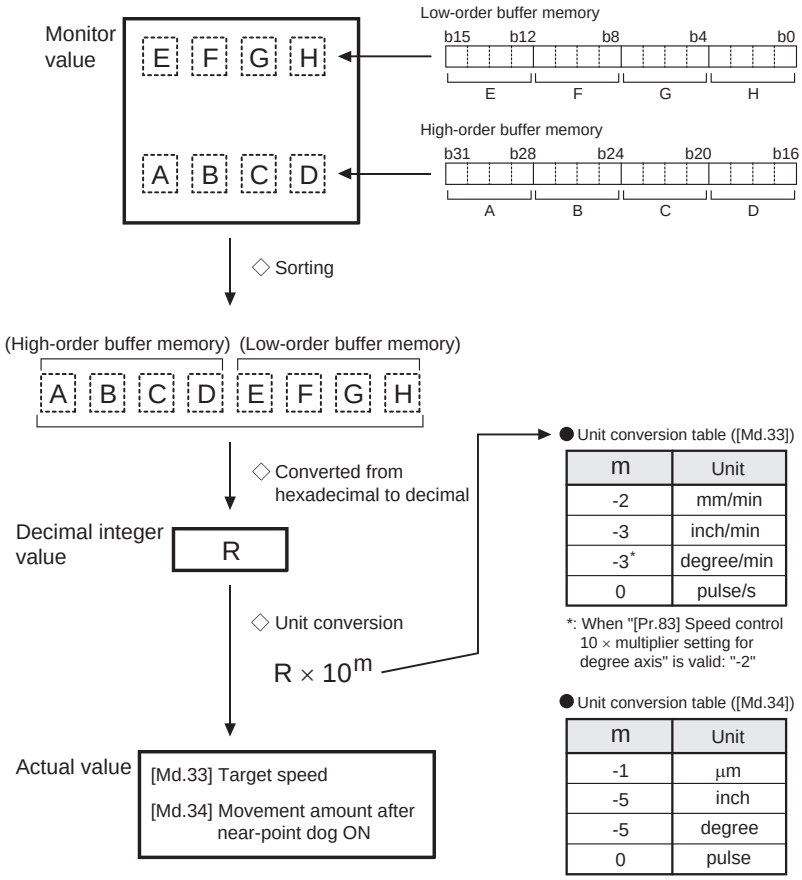
Refresh cycle: Immediate

**Point**

The target speed is when an override is made to the command speed.
When the speed limit value is overridden, the target speed is restricted to the speed limit value. The target speed changes every time data is switched, but does not change in an acceleration/deceleration state inside each piece of data (changes with the speed change because the target speed changes.)

### ■Reading the monitor value

- Monitoring is carried out with a hexadecimal display.




● Unit conversion table ([Md.33])

| m | Unit |
|---|---|
| -2 | mm/min |
| -3 | inch/min |
| -3* | degree/min |
| 0 | pulse/s |

*: When "[Pr.83] Speed control 10 × multiplier setting for degree axis" is valid: "-2"

● Unit conversion table ([Md.34])

| m | Unit |
|---|---|
| -1 | μm |
| -5 | inch |
| -5 | degree |
| 0 | pulse |

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 390 Monitor data

## [Md.34] Movement amount after near-point dog ON

- "0" is stored when machine home position return starts.
- After machine home position return starts, the movement amount from the near-point dog ON to the machine home position return completion is stored. (Movement amount: Movement amount to machine home position return completion using near-point dog ON as "0".)

Refresh cycle: Immediate

### ■Reading the monitor value

Refer to "[Md.33] Target speed".

☞ Page 486 [Md.33] Target speed

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 390 Monitor data



## [Md.35] Torque limit stored value/forward torque limit stored value

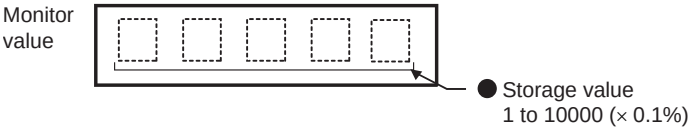
"[Pr.17] Torque limit setting value", "[Cd.101] Torque output setting value", "[Cd.22] New torque value/forward new torque value", or "[Pr.54] Home position return torque limit value" is stored.

- During positioning start, JOG operation start, manual pulse generator operation: "[Pr.17] Torque limit setting value" or "[Cd.101] Torque output setting value" is stored.
- When a value is set in "[Cd.22] New torque value/forward new torque value" during operation: "[Cd.22] New torque value/forward new torque value" is stored.
- When home position return: "[Pr.17] Torque limit setting value" or "[Cd.101] Torque output setting value" is stored. However, "[Pr.54] Home position return torque limit value" is stored after the speed reaches "[Pr.47] Creep speed".

Refresh cycle: Immediate

### ■Reading the monitor value

- Monitoring is carried out with a decimal display.




- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 390 Monitor data

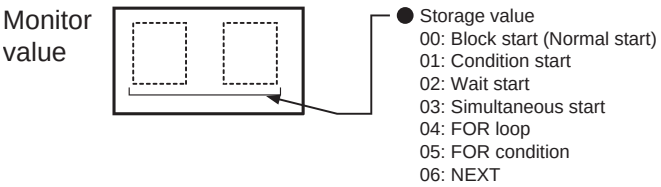
## [Md.36] Special start data instruction code setting value

- The "instruction code" used with special start and indicated by the start data pointer currently being executed is stored.

Refresh cycle: Immediate

### ■Reading the monitor value

- Monitoring is carried out with a decimal display.




- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 390 Monitor data

## [Md.37] Special start data instruction parameter setting value

- The "instruction parameter" used with special start and indicated by the start data pointer currently being executed is stored. The stored value differs according to the value set for [Md.36].

Refresh cycle: Immediate

### ■Reading the monitor value

- Monitoring is carried out with a decimal display.

Monitor value

● Storage value

| Setting value of [Md.36] | Stored contents | Stored value |
|---|---|---|
| 00<br>06 | None | None |
| 01<br>02<br>03<br>05 | Condition data No. | 1 to 10 |
| 04 | Number of repetitions | 0 to 255 |

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 390 Monitor data

## [Md.38] Start positioning data No. setting value

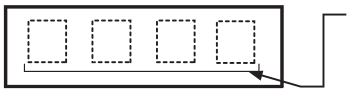
- The "positioning data No." indicated by the start data pointer currently being executed is stored.

Refresh cycle: Immediate

### ■Reading the monitor value

- Monitoring is carried out with a decimal display.

Monitor value



● Storage value
1 to 600, 9001 to 9003

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 390 Monitor data

## [Md.39] In speed limit flag

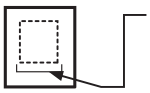
- If the speed exceeds the "[Pr.8] Speed limit value" ("[Pr.31] JOG speed limit value" at JOG operation control) due to a speed change or override, the speed limit functions, and the in speed limit flag turns ON.
- When the speed drops to less than "[Pr.8] Speed limit value" ("[Pr.31] JOG speed limit value" at JOG operation control), or when the axis stops, the in speed limit flag turns OFF.

Refresh cycle: Immediate

### ■Reading the monitor value

- Monitoring is carried out with a decimal display.

Monitor value



● Storage value
0: Not in speed limit (OFF)
1: In speed limit (ON)

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 390 Monitor data

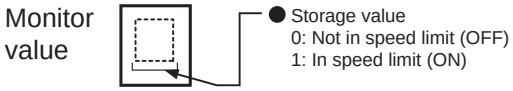
## [Md.40] In speed change processing flag

- The speed change process flag turns ON when the speed is changed during positioning control.
- After the speed change process is completed or when deceleration starts with the stop signal during the speed change process, the in speed change process flag turns OFF.

Refresh cycle: Immediate

### ■Reading the monitor value

- Monitoring is carried out with a decimal display.




- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 390 Monitor data

## [Md.41] Special start repetition counter

- This area stores the remaining number of repetitions during "repetitions" specific to special starting.
- The count is decremented by one (-1) at the loop end.
- The control comes out of the loop when the count reaches "0".
- This area stores "0" within an infinite loop.

Refresh cycle: Immediate

### ■Reading the monitor value

- Monitoring is carried out with a decimal display.

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 390 Monitor data

## [Md.42] Control system repetition counter

- This area stores the remaining number of repetitions during "repetitions" specific to control system.
- The count is decremented by one (-1) at the loop start.
- The loop is terminated with the positioning data of the control method "LEND", after the counter becomes "0".

Refresh cycle: Immediate

### ■Reading the monitor value

- Monitoring is carried out with a hexadecimal display.

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 390 Monitor data

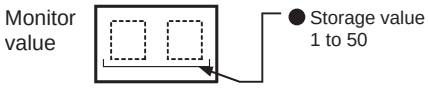
## [Md.43] Start data pointer being executed

- This area stores a point No. (1 to 50) attached to the start data currently being executed.
- This area stores "0" after completion of a positioning operation.

Refresh cycle: Immediate

### ■Reading the monitor value

- Monitoring is carried out with a decimal display.




- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 390 Monitor data

## [Md.44] Positioning data No. being executed

- This area stores a positioning data No. attached to the positioning data currently being executed.
- This area stores "0" when the JOG/inching operation is executed.

Refresh cycle: Immediate

### ■Reading the monitor value

- Monitoring is carried out with a decimal display.

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 390 Monitor data

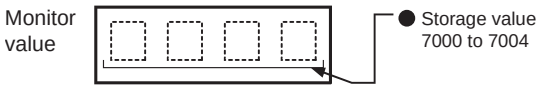
## [Md.45] Block No. being executed

- When the operation is controlled by "block start data", this area stores a block number (7000 to 7004) attached to the block currently being executed.
- At other times, this area stores "0".

Refresh cycle: At start

### ■Reading the monitor value

- Monitoring is carried out with a decimal display.




- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 390 Monitor data

## [Md.46] Last executed positioning data No.

- This area stores the positioning data No. attached to the positioning data that was executed last time.
- The value is retained until a new positioning operation is executed.
- This area stores "0" when the JOG/inching operation is executed.

Refresh cycle: Immediate

### ■Reading the monitor value

- Monitoring is carried out with a decimal display.

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 390 Monitor data

## [Md.47] Positioning data being executed

- The details of the positioning data currently being executed (positioning data No. given by [Md.44]) are stored in the buffer memory addresses.

Refresh cycle: Immediate

### ■Reading the monitor value

Information is stored in the storage addresses:

| Stored item | Reference |
|---|---|
| Positioning identifier | ☞ Page 448 [Da.1] Operation pattern to ☞ Page 449 [Da.4] Deceleration time No. |
| Positioning address | ☞ Page 449 [Da.6] Positioning address/movement amount |
| Arc address | ☞ Page 453 [Da.7] Arc address |
| Command speed | ☞ Page 455 [Da.8] Command speed |
| Dwell time | ☞ Page 456 [Da.9] Dwell time/JUMP destination positioning data No. |
| M code | ☞ Page 457 [Da.10] M code/Condition data No./No. of LOOP to LEND repetitions/No. of pitches |
| Axis to be interpolated | ☞ Page 458 [Da.20] Axis to be interpolated No.1 to [Da.22] Axis to be interpolated No.3 |
| Positioning option | ☞ Page 458 [Da.27] M code ON signal output timing to ☞ Page 459 [Da.29] Interpolation speed designation method |

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 390 Monitor data

## [Md.48] Deceleration start flag

- "1" is stored when the constant speed status or acceleration status switches to the deceleration status during position control whose operation pattern is "Positioning complete".
- "0" is stored at the next operation start or manual pulse generator operation enable.

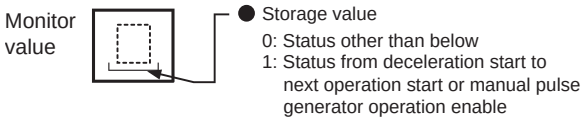
Refresh cycle: Immediate

**Point**

This parameter is possible to monitor when "[Cd.41] Deceleration start flag valid" is valid.

### ■Reading the monitor value

- Monitoring is carried out with a decimal display.


Monitor value
Storage value
0: Status other than below
1: Status from deceleration start to next operation start or manual pulse generator operation enable

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 390 Monitor data

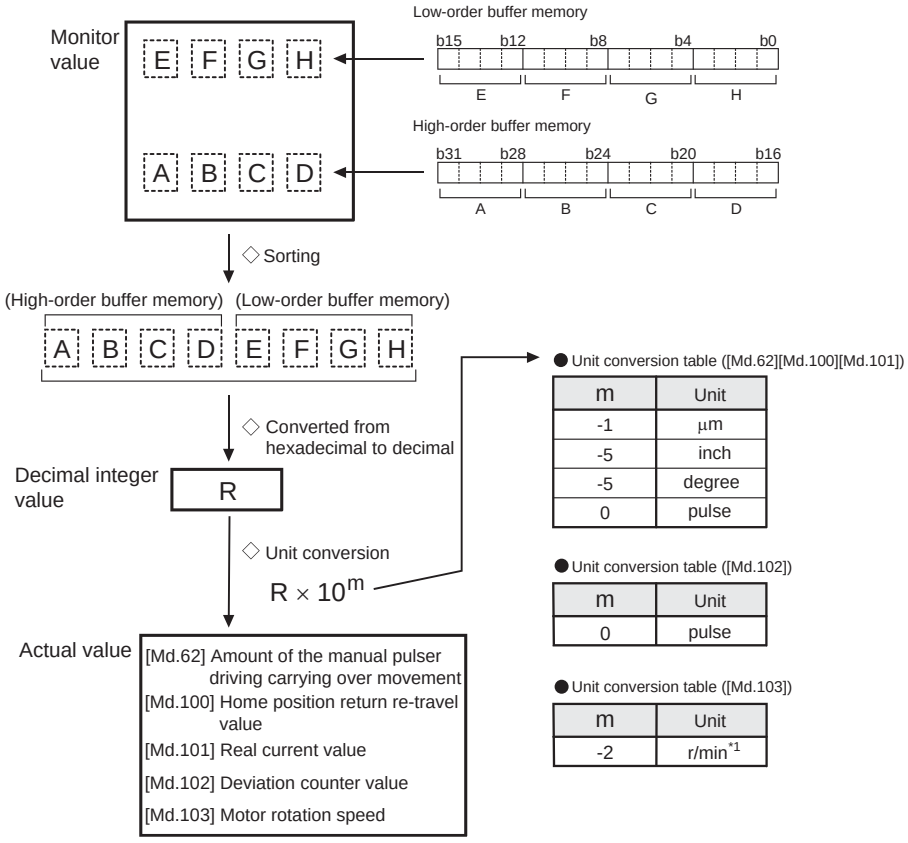
## [Md.62] Amount of the manual pulser driving carrying over movement

- When "2: Output over value of speed limit later" is set in "[Pr.122] Manual pulse generator speed limit mode", this area stores the carrying over movement amount which exceeds "[Pr.123] Manual pulse generator speed limit value".

Refresh cycle: Immediate

### ■Reading the monitor value

- Monitoring is carried out with a hexadecimal display.


Monitor value
E F G H
A B C D
Low-order buffer memory
b15 b12 b8 b4 b0
E F G H
High-order buffer memory
b31 b28 b24 b20 b16
A B C D
◇Sorting
(High-order buffer memory) (Low-order buffer memory)
A B C D E F G H
◇Converted from hexadecimal to decimal
Decimal integer value
R
◇Unit conversion
R × 10^m
Actual value
[Md.62] Amount of the manual pulser driving carrying over movement
[Md.100] Home position return re-travel value
[Md.101] Real current value
[Md.102] Deviation counter value
[Md.103] Motor rotation speed

● Unit conversion table ([Md.62][Md.100][Md.101])

| m | Unit |
|---|---|
| -1 | μm |
| -5 | inch |
| -5 | degree |
| 0 | pulse |

● Unit conversion table ([Md.102])

| m | Unit |
|---|---|
| 0 | pulse |

● Unit conversion table ([Md.103])

| m | Unit |
|---|---|
| -2 | r/min*1 |

*1 The unit is mm/s at linear servo use.

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 390 Monitor data

## [Md.100] Home position return re-travel value

- This area stores the travel distance during the home position return travel to the zero point that was executed last time. "0" is stored at machine home position return start.

For setting units

Ex.

mm

(Buffer memory × 0.1) μm

Refresh cycle: Immediate

### ■Reading the monitor value

Refer to the following.

☞ Page 492 [Md.62] Amount of the manual pulser driving carrying over movement

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 390 Monitor data

## [Md.101] Real current value

- This area stores the current value "feed current value - (command pulse - feedback pulse)".

For setting units

Ex.

mm

(Buffer memory × 0.1) μm

Refresh cycle: Operation cycle

### ■Reading the monitor value

Refer to the following.

☞ Page 492 [Md.62] Amount of the manual pulser driving carrying over movement

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 390 Monitor data

## [Md.102] Deviation counter value

• This area stores the pulse droop.

(Buffer memory details) pulse

Refresh cycle: Operation cycle

### ■Reading the monitor value

Refer to the following.

☞ Page 492 [Md.62] Amount of the manual pulser driving carrying over movement

• Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 390 Monitor data

## [Md.103] Motor rotation speed

• This area stores the motor speed updated in real time.

(Buffer memory × 0.01) r/min*1

*1 The unit is mm/s at linear servo use.

Refresh cycle: Operation cycle

### ■Reading the monitor value

Refer to the following.

☞ Page 492 [Md.62] Amount of the manual pulser driving carrying over movement

• Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 390 Monitor data

## [Md.104] Motor current value

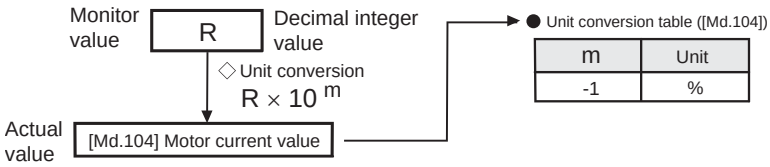
• This area stores the present motor current value of the motor.

(Buffer memory × 0.1)%

Refresh cycle: Operation cycle

### ■Reading the monitor value

• Monitoring is carried out with a decimal display.




• Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 390 Monitor data

## [Md.106] Servo amplifier software No.

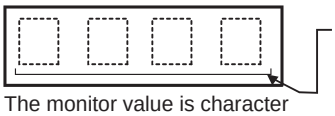
- This area stores the software No. of the servo amplifier used.
- This area is update when the control power of the servo amplifier is turned ON.

Refresh cycle: Servo amplifier's power supply ON

### ■Reading the monitor value

- Monitoring is carried out with a hexadecimal display.

Monitor value



Software No.

The monitor value is character code (ASCII format).

Example) -B35W200_A0_

| Address | Monitor value | Stored value |
|---|---|---|
| 2464 | 422D | - B |
| 2465 | 3533 | 3 5 |
| 2466 | 3257 | W 2 |
| 2467 | 3030 | 0 0 |
| 2468 | 4120 | SPACE A |
| 2469 | 2030 | 0 SPACE |

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 390 Monitor data

## [Md.107] Parameter error No.

- When a servo parameter error occurs, the area that corresponds to the parameter number affected by the error comes ON.
- When the "[Cd.5] Axis error reset" (axis control data) is set to ON after remove the error factor of servo amplifier side, the servo alarm is cleared (set to 0).

Refresh cycle: Immediate

### ■Reading the monitor value

- Monitoring is carried out with a decimal display.

Monitor value

● Storage value

- When SSCNET setting is SSCNETⅢ/H

| Stored value | Parameter No. |
|---|---|
| 1 to 64 | PA01 to PA64 |
| 64 to 128 | PB01 to PB64 |
| 129 to 192 | PC01 to PC64 |
| 193 to 256 | PD01 to PD64 |
| 257 to 320 | PE01 to PE64 |
| 321 to 384 | PF01 to PF64 |
| 385 to 448 | Po01 to Po64 |
| 449 to 512 | PS01 to PS64 |
| 513 to 576 | PL01 to PL64 |

- When SSCNET setting is SSCNETⅢ

| Stored value | Parameter No. |
|---|---|
| 1 to 18 | PA01 to PA18 |
| 19 to 63 | PB01 to PB45 |
| 64 to 95 | PC01 to PC32 |
| 96 to 127 | PD01 to PD32 |
| 128 to 167 | PE01 to PE40 |
| 168 to 183 | PF01 to PF16 |
| 184 to 199 | Po01 to Po16 |
| 200 to 231 | PS01 to PS32 |
| 232 | PA19 |

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 390 Monitor data

## [Md.108] Servo status1

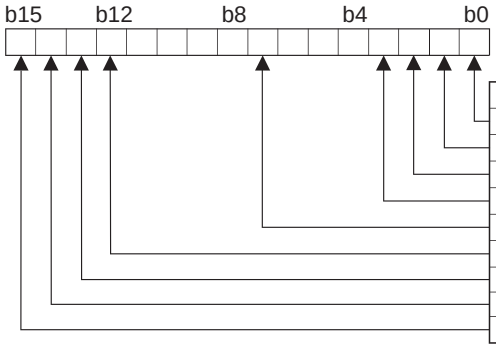
This area stores the servo status1.

- READY ON: Indicates the ready ON/OFF.
- Servo ON: Indicates the servo ON/OFF.
- Control mode: Indicates the control mode of the servo amplifier.
- Servo alarm: Turns ON during the servo alarm.
- In-position: The dwell pulse turns ON within the servo parameter "in-position".
- Torque limit: Turns ON when the servo amplifier is having the torque restricted.
- Absolute position lost: Turns ON when the servo amplifier is lost the absolute position.
- Servo warning: Turns ON during the servo warning.

Refresh cycle: Operation cycle

### ■Reading the monitor value

- Monitoring is carried out with a hexadecimal display.




| Stored items | | Meaning |
|---|---|---|
| b0 | READY ON | 0: OFF<br>1: ON |
| b1 | Servo ON | |
| b2 | Control mode * | |
| b3 | | |
| b7 | Servo alarm | |
| b12 | In-position | |
| b13 | Torque limit | |
| b14 | Absolute position lost | |
| b15 | Servo warning | |

*: Control mode

| b2 | b3 | Control mode |
|---|---|---|
| 0 | 0 | Position control mode |
| 1 | 0 | Speed control mode |
| 0 | 1 | Torque control mode |

**Point**

- When the forced stop of controller and servo amplifier occurs, the servo warning is turned ON. When the forced stop is reset, the servo warning is turned OFF.
- Confirm the status during continuous operation to torque control mode with "[Md.125] Servo status3".

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 390 Monitor data

## [Md.109] Regenerative load ratio/Optional data monitor output 1

- The rate of regenerative power to the allowable regenerative power is indicated as a percentage.
- When the regenerative option is used, the rate to the allowable regenerative power of the option is indicated.

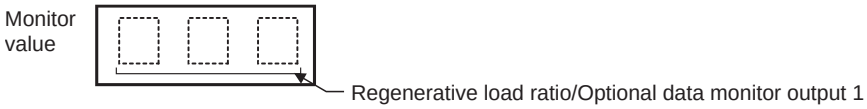
(Buffer memory) %

- This area stores the content set in "[Pr.91] Optional data monitor: Data type setting 1" at optional data monitor data type setting.

Refresh cycle: Operation cycle

### ■Reading the monitor value

- Monitoring is carried out with a decimal display.




- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 390 Monitor data

## [Md.110] Effective load torque/Optional data monitor output 2

- The continuous effective load torque is indicated.
- The average value of the load rates for the past 15 seconds to the rated torque is stored as a percentage, rated torque being 100%.

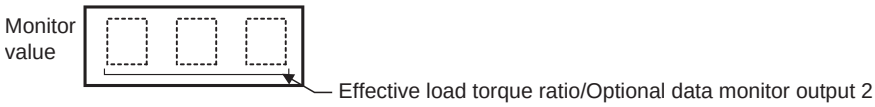
(Buffer memory) %

- This area stores the content set in "[Pr.92] Optional data monitor: Data type setting 2" at optional data monitor data type setting.

Refresh cycle: Operation cycle

### ■Reading the monitor value

- Monitoring is carried out with a decimal display.




- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 390 Monitor data

## [Md.111] Peak torque ratio/Optional data monitor output 3

- The maximum torque is indicated. (Holding value)
- The peak values for the past 15 seconds are indicated, rated torque being 100%.

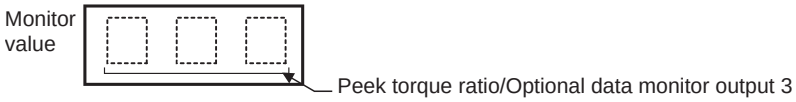
(Buffer memory) %

- This area stores the content set in "[Pr.93] Optional data monitor: Data type setting 3" at optional data monitor data type setting.

Refresh cycle: Operation cycle

### ■Reading the monitor value

- Monitoring is carried out with a decimal display.




- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 390 Monitor data

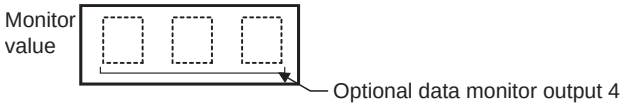
## [Md.112] Optional data monitor output 4

- This area stores the content set in "[Pr.94] Optional data monitor: Data type setting 4" at optional data monitor data type setting. ("0" is stored when the optional data monitor data type is not set.)

Refresh cycle: Operation cycle

### ■Reading the monitor value

- Monitoring is carried out with a decimal display.




- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 390 Monitor data

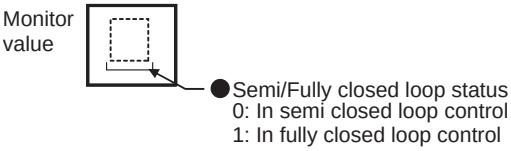
## [Md.113] Semi/Fully closed loop status

- The switching status of semi closed loop control/fully closed loop control is indicated.

Refresh cycle: Operation cycle

### ■Reading the monitor value

- Monitoring is carried out with a decimal display.




- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 390 Monitor data

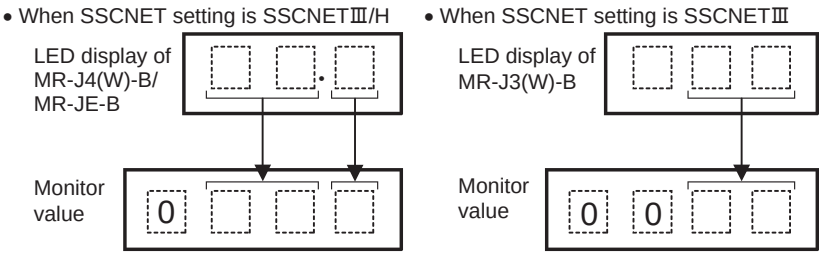
## [Md.114] Servo alarm

- This area stores the servo alarm code and servo warning code displayed in LED of servo amplifier.
- When the "[Cd.5] Axis error reset" (axis control data) is set to ON after remove the error factor of servo amplifier side, the servo alarm is cleared (set to 0).

Refresh cycle: Immediate

### ■Reading the monitor value

- Monitoring is carried out with a hexadecimal display.




- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 390 Monitor data

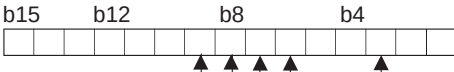
## [Md.116] Encoder option information

• The option information of encoder is indicated.

Refresh cycle: Servo amplifier's power supply ON

### ■Reading the monitor value

• Monitoring is carried out with a hexadecimal display.




| | Stored items | Details |
|---|---|---|
| b3 | ABS/INC mode distinction for magnetism type encoder * | 0: INC mode<br>1: ABS mode |
| b6 | Connecting to single-revolution ABS encoder * | 0: Multi-revolution ABS/INC<br>1: Single-revolution ABS |
| b7 | Connecting to magnetism type encoder * | 0: No connection<br>1: Magnetism type encoder |
| b8 | Compatible with continuous operation to torque control | 0: Incompatible<br>1: Compatible |
| b9 | Compatible with scale measurement mode | 0: Incompatible<br>1: Compatible |

*: Servo amplifier compatible with direct drive motor use
(Refer to each servo amplifier instruction manual for details.)

• Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 390 Monitor data

## [Md.119] Servo status2

This area stores the servo status2.

• Zero point pass: Turns ON if the zero point of the encoder has been passed even once.

• Zero speed: Turns ON when the motor speed is lower than the servo parameter "zero speed."

• Speed limit: Turns ON during the speed limit in torque control mode.

• PID control: Turns ON when the servo amplifier is PID control.

Refresh cycle: Operation cycle

### ■Reading the monitor value

• Monitoring is carried out with a hexadecimal display.

| | Stored items | Meaning |
|---|---|---|
| b0 | Zero point pass | 0: OFF<br>1: ON |
| b3 | Zero speed | |
| b4 | Speed limit | |
| b8 | PID control | |

• Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 390 Monitor data

## [Md.120] Reverse torque limit stored value

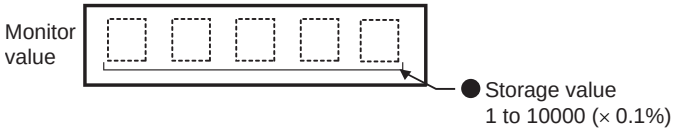
"[Pr.17] Torque limit setting value", "[Cd.101] Torque output setting value", "[Cd.113] Reverse new torque value", or "[Pr.54] Home position return torque limit value" is stored.

- At the positioning start/JOG operation start/manual pulse generator operation: "[Pr.17] Torque limit setting value" or "[Cd.101] Torque output setting value" is stored.
- When a value is set in "[Cd.22] New torque value/forward new torque value" or "[Cd.113] Reverse new torque value" during operation.: "[Cd.22] New torque value/forward new torque value" is stored when "0" is set in "[Cd.112] Torque change function switching request". "[Cd.113] Reverse new torque value" is stored when "1" is set in "[Cd.112] Torque change function switching request".
- At the home position return: "[Pr.17] Torque limit setting value" or "[Cd.101] Torque output setting value" is stored. However, "[Pr.54] Home position return torque limit value" is stored after the speed reaches "[Pr.47] Creep speed".

Refresh cycle: Immediate

### ■Reading the monitor value

- Monitoring is carried out with a decimal display.




- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 390 Monitor data

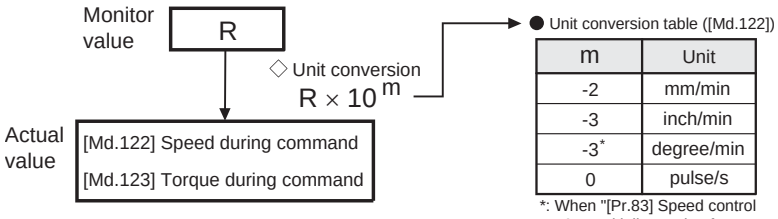
## [Md.122] Speed during command

- This area stores the command speed during speed control mode.
- This area stores the command speed during continuous operation to torque control mode.
- "0" is stored other than during speed control mode or continuous operation to torque control mode.

Refresh cycle: Operation cycle (Speed control mode and continuous operation to torque control mode only)

### ■Reading the monitor value

- Monitoring is carried out with a decimal display.




● Unit conversion table ([Md.122])

| m | Unit |
|---|---|
| -2 | mm/min |
| -3 | inch/min |
| -3* | degree/min |
| 0 | pulse/s |

*: When "[Pr.83] Speed control 10 × multiplier setting for degree axis" is valid: "-2"

● Unit conversion table ([Md.123])

| m | Unit |
|---|---|
| -1 | % |

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 390 Monitor data

## [Md.123] Torque during command

- This area stores the command torque during torque control mode. (Buffer memory × 0.1)%
- This area stores the command torque during continuous operation to torque control mode.
- "0" is stored other than during torque control mode or continuous operation to torque control mode.

Refresh cycle: Operation cycle (Torque control mode and continuous operation to torque control mode only)

### ■Reading the monitor value

Refer to "[Md.122] Speed during command".

☞ Page 500 [Md.122] Speed during command

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 390 Monitor data



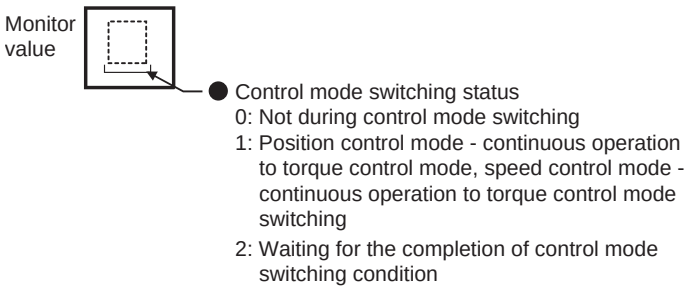
## [Md.124] Control mode switching status

- This area stores the switching status of control mode.

Refresh cycle: Operation cycle

### ■Reading the monitor value

- Monitoring is carried out with a decimal display.


Monitor value
● Control mode switching status
0: Not during control mode switching
1: Position control mode - continuous operation to torque control mode, speed control mode - continuous operation to torque control mode switching
2: Waiting for the completion of control mode switching condition

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 390 Monitor data

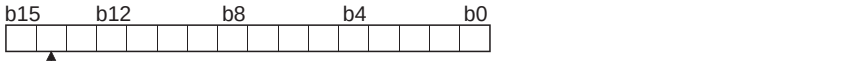
## [Md.125] Servo status3

- This area stores the servo status3.
- Continuous operation to torque control mode: Turn ON when the continuous operation to torque control mode.

Refresh cycle: Operation cycle

### ■Reading the monitor value

- Monitoring is carried out with a hexadecimal display.




| Stored items | | Meaning |
|---|---|---|
| b14 | Continuous operation to torque control mode | 0: OFF<br>1: ON |

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 390 Monitor data

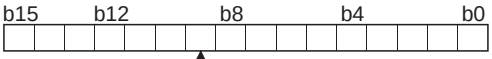
## [Md.500] Servo status7

• This area stores the servo status7.

Refresh cycle: Operation cycle

### ■Reading the monitor value

• Monitoring is carried out with a hexadecimal display.




| Stored items | | Meaning |
|---|---|---|
| b9 | Driver operation alarm | 0: OFF<br>1: ON |

• Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 390 Monitor data

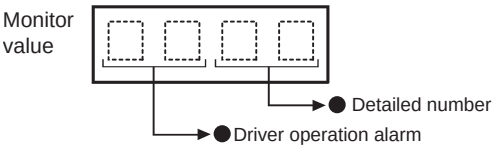
## [Md.502] Driver operation alarm number

• This area stores the driver operation alarm number.

Refresh cycle: Immediate

### ■Reading the monitor value

• Monitoring is carried out with a hexadecimal display.




**Ex.**

When the driver operation alarm is "10H" and the detailed number is "23H", "1023H" is displayed.

• Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 390 Monitor data

## [Md.503] Pre-reading data analysis status

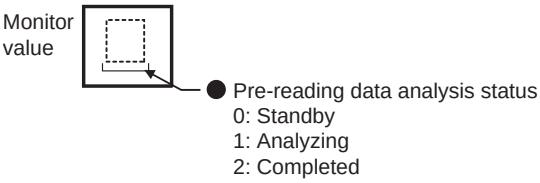
Use this monitor when using the pre-reading start function.

• This area stores the positioning data analysis status.

Refresh cycle: Operation cycle

### ■Reading the monitor value

• Monitoring is carried out with a decimal display.




• Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 390 Monitor data

# Servo network composition status

| Item | Default value |
|---|---|
| [Md.105] Connected device | 0 |

## [Md.105] Connected device

This area stores the vendor ID and module code of each axis when the power of the connected device is turned ON.

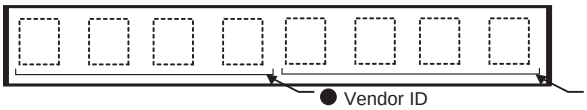
It is not cleared if the power of the connected device is turned OFF.

Refresh cycle: Servo amplifier's power supply ON

### ■Reading the monitor value

- Monitoring is carried out with a hexadecimal display.

Monitor value



● Vendor ID
0000: Mitsubishi electric
0008: Nikki Denso

● Identification code
• Vendor ID "0000: Mitsubishi electric"
0100: MR-J3-_B, MR-J3W-_B (2-axis type)
0101: MR-J3-_B-RJ006 (For fully closed loop control)
0102: MR-J3-_B-RJ004 (For linear servo motor)
0107: MR-J3-_B-RJ080W (For direct drive motor)
0180: MR-J3W-0303BN6
4100: FR-A700 (Inverter)
4101: FR-A700-NA (Inverter)
4102: FR-A700-EC (Inverter)
4103: FR-A700-CHT (Inverter)
0FFF: Virtual servo amplifier (MR-J3-B Standard)
1000: MR-J4-_B, MR-J4W-_B (2-, 3-axis type)
1200: MR-JE-B
1FFF: Virtual servo amplifier (MR-J4-B)
• Vendor ID "0008: Nikki Denso"
0102: VCⅡ (Manufactured by Nikki Denso Co., Ltd.) (For linear stage)
0107: VCⅡ (Manufactured by Nikki Denso Co., Ltd.) (For direct drive motor)
1000: VCⅡ (Manufactured by Nikki Denso Co., Ltd.)

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 390 Monitor data

# 12.8 Control Data

The setting items of the control data are explained in this section.

## System control data

| Item | Default value |
|---|---|
| [Cd.1] Flash ROM write request | 0 |
| [Cd.2] Parameter initialization request | 0 |
| [Cd.41] Deceleration start flag valid | 0 |
| [Cd.42] Stop command processing for deceleration stop selection | 0 |
| [Cd.44] External input signal operation device (Axis 1 to 16) | 0000H |
| [Cd.102] SSCNET control command | 0 |
| [Cd.137] Amplifier-less operation mode switching request | 0000H |

### [Cd.1] Flash ROM write request

- Writes not only "positioning data (No.1 to 600)" and "block start data (No.7000 to 7004)" stored in the buffer memory/ internal memory area, but also "parameters" and "servo parameters" to the flash ROM/internal memory (nonvolatile).

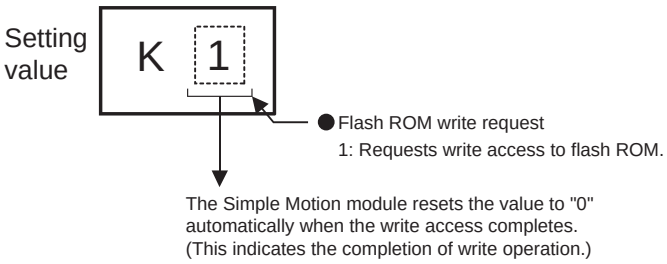
Fetch cycle: 103 [ms]

**Point**

- Do not turn the power OFF or reset the CPU module while writing to the flash ROM. If the power is turned OFF or the CPU module is reset to forcibly end the process, the data backed up in the flash ROM will be lost.
- Do not write the data to the buffer memory before writing to the flash ROM is completed.
- The number of writes to the flash ROM with the program is 25 max. while the power is turned ON. Writing to the flash ROM beyond 25 times will cause the error "Flash ROM write number error" (error code: 1080H). Refer to ☞ Page 591 List of Error Codes for details.
- Monitoring is the number of writes to the flash ROM after the power is switched ON by the "[Md.19] Number of write accesses to flash ROM".

#### ■Setting value

- Set with a decimal.


Setting value
K
1
●Flash ROM write request
1: Requests write access to flash ROM.
The Simple Motion module resets the value to "0" automatically when the write access completes.
(This indicates the completion of write operation.)

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 392 Control data

## [Cd.2] Parameter initialization request

• Requests initialization of setting data.

Refer to the following for initialized setting data.

☞ Page 304 Parameter Initialization Function

Initialization: Resetting of setting data to default values

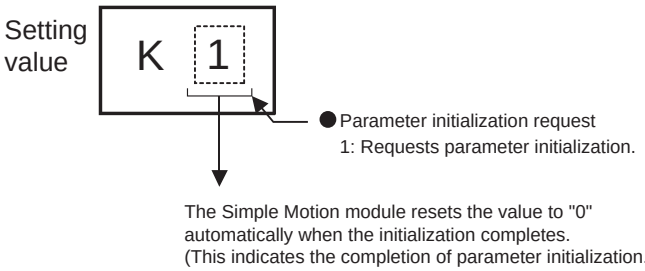
Fetch cycle: 103 [ms]

**Point**

After completing the initialization of setting data, switch the power ON or reset the CPU module.

### ■Setting value

• Set with a decimal.


Setting value
K
1
Parameter initialization request
1: Requests parameter initialization.
The Simple Motion module resets the value to "0" automatically when the initialization completes.
(This indicates the completion of parameter initialization.)

• Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 392 Control data

## [Cd.41] Deceleration start flag valid

• Sets whether "[Md.48] Deceleration start flag" is made valid or invalid.

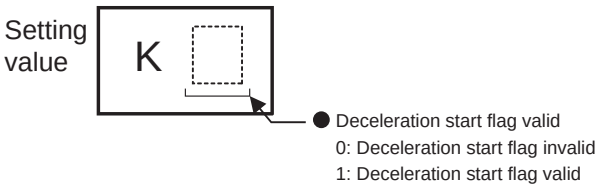
Fetch cycle: At PLC READY ON

**Point**

The "[Cd.41] Deceleration start flag valid" become valid when the PLC READY signal [Y0] turns from OFF to ON.

### ■Setting value

• Set with a decimal.




• Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 392 Control data

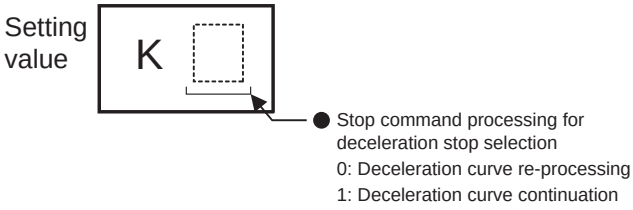
## [Cd.42] Stop command processing for deceleration stop selection

- Sets the stop command processing for deceleration stop function (deceleration curve re-processing/deceleration curve continuation).

Fetch cycle: At deceleration stop causes occurrence

### ■Setting value

- Set with a decimal.




- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 392 Control data

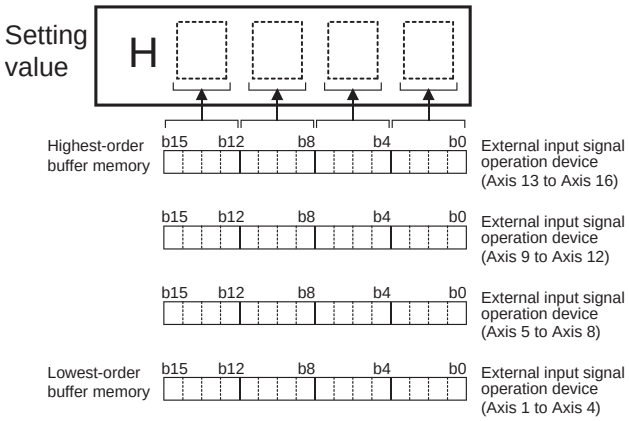
## [Cd.44] External input signal operation device (Axis 1 to 16)

- Operates the external input signal status (Upper/lower limit signal, near-point dog signal, stop signal) of the Simple Motion module when "2" is set in "[Pr.116] FLS signal selection", "[Pr.117] RLS signal selection", "[Pr.118] DOG signal selection", and "[Pr.119] STOP signal selection".

Fetch cycle: Operation cycle

### ■Setting value

- Set with a hexadecimal.


Setting value
H
Highest-order buffer memory
b15 b12 b8 b4 b0
External input signal operation device (Axis 13 to Axis 16)
b15 b12 b8 b4 b0
External input signal operation device (Axis 9 to Axis 12)
b15 b12 b8 b4 b0
External input signal operation device (Axis 5 to Axis 8)
Lowest-order buffer memory
b15 b12 b8 b4 b0
External input signal operation device (Axis 1 to Axis 4)

| Buffer memory | Setting item | Default value | Meaning |
|---|---|---|---|
| b0 | Axis 1 Upper limit signal (FLS) | 0 | |
| b1 | Axis 1 Lower limit signal (RLS) | 0 | |
| b2 | Axis 1 Near-point dog signal (DOG) | 0 | |
| b3 | Axis 1 STOP signal (STOP) | 0 | |
| b4 | Axis 2 Upper limit signal (FLS) | 0 | |
| b5 | Axis 2 Lower limit signal (RLS) | 0 | |
| b6 | Axis 2 Near-point dog signal (DOG) | 0 | |
| b7 | Axis 2 STOP signal (STOP) | 0 | |
| b8 | Axis 3 Upper limit signal (FLS) | 0 | "[Pr.22] Input signal logic selection" is negative logic 0: ON 1: OFF |
| b9 | Axis 3 Lower limit signal (RLS) | 0 | |
| b10 | Axis 3 Near-point dog signal (DOG) | 0 | |
| b11 | Axis 3 STOP signal (STOP) | 0 | |
| b12 | Axis 4 Upper limit signal (FLS) | 0 | |
| b13 | Axis 4 Lower limit signal (RLS) | 0 | |
| b14 | Axis 4 Near-point dog signal (DOG) | 0 | |
| b15 | Axis 4 STOP signal (STOP) | 0 | |
| b0 | Axis 5 Upper limit signal (FLS) | 0 | "[Pr.22] Input signal logic selection" is positive logic 0: ON 1: OFF |
| b1 | Axis 5 Lower limit signal (RLS) | 0 | |
| b2 | Axis 5 Near-point dog signal (DOG) | 0 | |
| b3 | Axis 5 STOP signal (STOP) | 0 | |
| b4 | Axis 6 Upper limit signal (FLS) | 0 | |
| b5 | Axis 6 Lower limit signal (RLS) | 0 | |
| b6 | Axis 6 Near-point dog signal (DOG) | 0 | |
| b7 | Axis 6 STOP signal (STOP) | 0 | |
| b8 | Axis 7 Upper limit signal (FLS) | 0 | |
| b9 | Axis 7 Lower limit signal (RLS) | 0 | |
| b10 | Axis 7 Near-point dog signal (DOG) | 0 | |
| b11 | Axis 7 STOP signal (STOP) | 0 | |
| b12 | Axis 8 Upper limit signal (FLS) | 0 | |
| b13 | Axis 8 Lower limit signal (RLS) | 0 | |
| b14 | Axis 8 Near-point dog signal (DOG) | 0 | |
| b15 | Axis 8 STOP signal (STOP) | 0 | |

| Buffer memory | Setting item | Default value | Meaning |
|---|---|---|---|
| b0 | Axis 9 Upper limit signal (FLS) | 0 | |
| b1 | Axis 9 Lower limit signal (RLS) | 0 | |
| b2 | Axis 9 Near-point dog signal (DOG) | 0 | |
| b3 | Axis 9 STOP signal (STOP) | 0 | |
| b4 | Axis 10 Upper limit signal (FLS) | 0 | |
| b5 | Axis 10 Lower limit signal (RLS) | 0 | |
| b6 | Axis 10 Near-point dog signal (DOG) | 0 | |
| b7 | Axis 10 STOP signal (STOP) | 0 | |
| b8 | Axis 11 Upper limit signal (FLS) | 0 | "[Pr.22] Input signal logic selection" is negative logic 0: ON 1: OFF |
| b9 | Axis 11 Lower limit signal (RLS) | 0 | |
| b10 | Axis 11 Near-point dog signal (DOG) | 0 | |
| b11 | Axis 11 STOP signal (STOP) | 0 | |
| b12 | Axis 12 Upper limit signal (FLS) | 0 | |
| b13 | Axis 12 Lower limit signal (RLS) | 0 | |
| b14 | Axis 12 Near-point dog signal (DOG) | 0 | |
| b15 | Axis 12 STOP signal (STOP) | 0 | |
| b0 | Axis 13 Upper limit signal (FLS) | 0 | "[Pr.22] Input signal logic selection" is positive logic 0: ON 1: OFF |
| b1 | Axis 13 Lower limit signal (RLS) | 0 | |
| b2 | Axis 13 Near-point dog signal (DOG) | 0 | |
| b3 | Axis 13 STOP signal (STOP) | 0 | |
| b4 | Axis 14 Upper limit signal (FLS) | 0 | |
| b5 | Axis 14 Lower limit signal (RLS) | 0 | |
| b6 | Axis 14 Near-point dog signal (DOG) | 0 | |
| b7 | Axis 14 STOP signal (STOP) | 0 | |
| b8 | Axis 15 Upper limit signal (FLS) | 0 | |
| b9 | Axis 15 Lower limit signal (RLS) | 0 | |
| b10 | Axis 15 Near-point dog signal (DOG) | 0 | |
| b11 | Axis 15 STOP signal (STOP) | 0 | |
| b12 | Axis 16 Upper limit signal (FLS) | 0 | |
| b13 | Axis 16 Lower limit signal (RLS) | 0 | |
| b14 | Axis 16 Near-point dog signal (DOG) | 0 | |
| b15 | Axis 16 STOP signal (STOP) | 0 | |

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 392 Control data

## [Cd.102] SSCNET control command

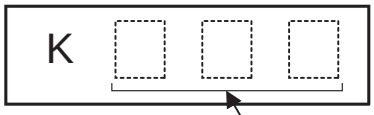
• Sets the connect/disconnect command of SSCNET communication.

Fetch cycle: 3.5 [ms]

### ■Setting value

• Set with a decimal.

Setting value




● SSCNET control command

| | |
|---|---|
| 0 | : No command |
| Axis No.*1 | : Disconnect command of SSCNET communication (Axis No. to be disconnected) |
| -2 | : Execute command |
| -10 | : Connect command of SSCNET communication |
| Except above setting | : Invalid |

*1: 1 to the maximum control axes

• Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 392 Control data

## [Cd.137] Amplifier-less operation mode switching request

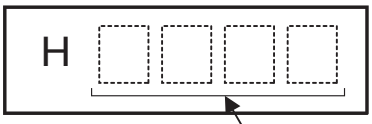
• Sets the switching request of the normal operation mode and amplifier-less operation mode.

Fetch cycle: 3.5 [ms]

### ■Setting value

• Set with a hexadecimal.

Setting value




● Amplifier-less operation mode switching request

| | |
|---|---|
| ABCDH: | Change from normal operation mode to amplifier-less operation mode |
| 0000H: | Change from amplifier-less operation mode to normal operation mode |

• Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 392 Control data

# Axis control data

| Item | Default value |
|---|---|
| [Cd.3] Positioning start No. | 0 |
| [Cd.4] Positioning starting point No. | 0 |
| [Cd.5] Axis error reset | 0 |
| [Cd.6] Restart command | 0 |
| [Cd.7] M code OFF request | 0 |
| [Cd.8] External command valid | 0 |
| [Cd.9] New current value | 0 |
| [Cd.10] New acceleration time value | 0 |
| [Cd.11] New deceleration time value | 0 |
| [Cd.12] Acceleration/deceleration time change value during speed change, enable/disable | 0 |
| [Cd.13] Positioning operation speed override | 100 |
| [Cd.14] New speed value | 0 |
| [Cd.15] Speed change request | 0 |
| [Cd.16] Inching movement amount | 0 |
| [Cd.17] JOG speed | 0 |
| [Cd.18] Interrupt request during continuous operation | 0 |
| [Cd.19] Home position return request flag OFF request | 0 |
| [Cd.20] Manual pulse generator 1 pulse input magnification | 1 |
| [Cd.21] Manual pulse generator enable flag | 0 |
| [Cd.22] New torque value/forward new torque value | 0 |
| [Cd.23] Speed-position switching control movement amount change register | 0 |
| [Cd.24] Speed-position switching enable flag | 0 |
| [Cd.25] Position-speed switching control speed change register | 0 |
| [Cd.26] Position-speed switching enable flag | 0 |
| [Cd.27] Target position change value (New address) | 0 |
| [Cd.28] Target position change value (New speed) | 0 |
| [Cd.29] Target position change request flag | 0 |
| [Cd.30] Simultaneous starting own axis start data No. | 0 |
| [Cd.31] Simultaneous starting axis start data No.1 | 0 |
| [Cd.32] Simultaneous starting axis start data No.2 | 0 |
| [Cd.33] Simultaneous starting axis start data No.3 | 0 |
| [Cd.34] Step mode | 0 |
| [Cd.35] Step valid flag | 0 |
| [Cd.36] Step start information | 0 |
| [Cd.37] Skip command | 0 |
| [Cd.38] Teaching data selection | 0 |
| [Cd.39] Teaching positioning data No. | 0 |
| [Cd.40] ABS direction in degrees | 0 |
| [Cd.43] Simultaneous starting axis | 0000H |
| [Cd.45] Speed-position switching device selection | 0 |
| [Cd.46] Speed-position switching command | 0 |
| [Cd.100] Servo OFF command | 0 |
| [Cd.101] Torque output setting value | 0 |
| [Cd.108] Gain changing command flag | 0 |
| [Cd.112] Torque change function switching request | 0 |
| [Cd.113] Reverse new torque value | 0 |
| [Cd.130] Servo parameter write request | 0 |
| [Cd.131] Parameter No. (Setting for servo parameters to be changed) | 0000H |
| [Cd.132] Change data | 0 |
| [Cd.133] Semi/Fully closed loop switching request | 0 |
| [Cd.136] PI-PID switching request | 0 |

| Item | Default value |
|---|---|
| [Cd.138] Control mode switching request | 0 |
| [Cd.139] Control mode setting | 0 |
| [Cd.140] Command speed at speed control mode | 0 |
| [Cd.141] Acceleration time at speed control mode | 1000 |
| [Cd.142] Deceleration time at speed control mode | 1000 |
| [Cd.143] Command torque at torque control mode | 0 |
| [Cd.144] Torque time constant at torque control mode (Forward direction) | 1000 |
| [Cd.145] Torque time constant at torque control mode (Negative direction) | 1000 |
| [Cd.146] Speed limit value at torque control mode | 1 |
| [Cd.147] Speed limit value at continuous operation to torque control mode | 0 |
| [Cd.148] Acceleration time at continuous operation to torque control mode | 1000 |
| [Cd.149] Deceleration time at continuous operation to torque control mode | 1000 |
| [Cd.150] Target torque at continuous operation to torque control mode | 0 |
| [Cd.151] Torque time constant at continuous operation to torque control mode (Forward direction) | 1000 |
| [Cd.152] Torque time constant at continuous operation to torque control mode (Negative direction) | 1000 |
| [Cd.153] Control mode auto-shift selection | 0 |
| [Cd.154] Control mode auto-shift parameter | 0 |
| [Cd.180] Axis stop | 0 |
| [Cd.181] Forward run JOG start | 0 |
| [Cd.182] Reverse run JOG start | 0 |
| [Cd.183] Execution prohibition flag | 0 |

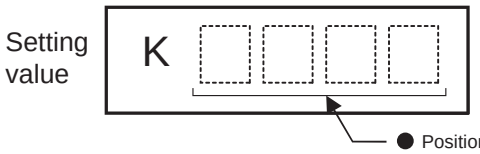
## [Cd.3] Positioning start No.

- Sets the positioning start No. (Only 1 to 600 for the Pre-reading start function. For details, refer to ☞ Page 266 Pre-reading start function.)

Fetch cycle: At start

### ■Setting value

- Set with a decimal.




● Positioning data No.

- 1 to 600 : Positioning data No.
- 7000 to7004 : Block start designation
- 9001 : Machine home position return
- 9002 : Fast-home position return
- 9003 : Current value changing
- 9004 : Simultaneous starting of multiple axes

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 392 Control data

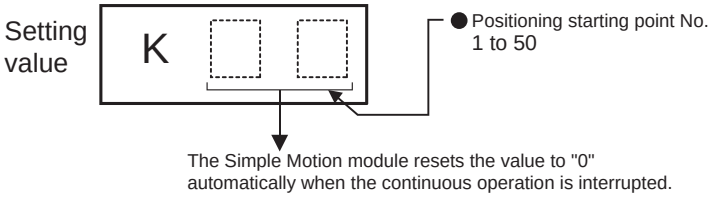
## [Cd.4] Positioning starting point No.

- Sets a "starting point No." (1 to 50) if block start data is used for positioning. (Handled as "1" if the value other than 1 to 50 is set.)

Fetch cycle: At start

### ■Setting value

- Set with a decimal.


Setting value
K
Positioning starting point No.
1 to 50
The Simple Motion module resets the value to "0" automatically when the continuous operation is interrupted.

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 392 Control data

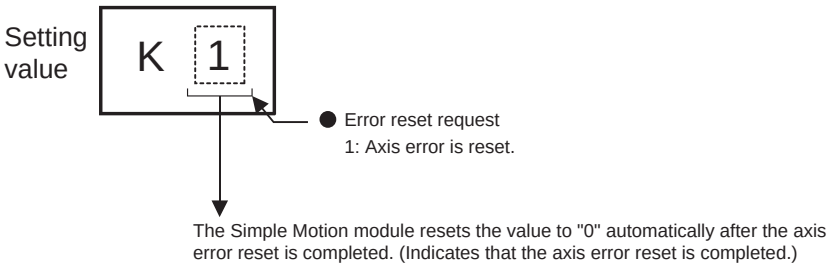
## [Cd.5] Axis error reset

- Clears the axis error detection, axis error No., axis warning detection and axis warning No.
- When the axis operation state of Simple Motion module is "in error occurrence", the error is cleared and the Simple Motion module is returned to the "waiting" state.
- Clears the both of Simple Motion module errors and servo amplifier errors by axis error reset. (Some servo amplifier errors cannot be reset even if error reset is requested. At the time, "0" is not stored in [Cd.5] by the Simple Motion module. It remains "1". Set "0" in [Cd.5] and then set "1" to execute the error reset again by user side. For details, refer to each servo amplifier instruction manual.)

Fetch cycle: 14.2 [ms]

### ■Setting value

- Set with a decimal.


Setting value
K
1
Error reset request
1: Axis error is reset.
The Simple Motion module resets the value to "0" automatically after the axis error reset is completed. (Indicates that the axis error reset is completed.)

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 392 Control data

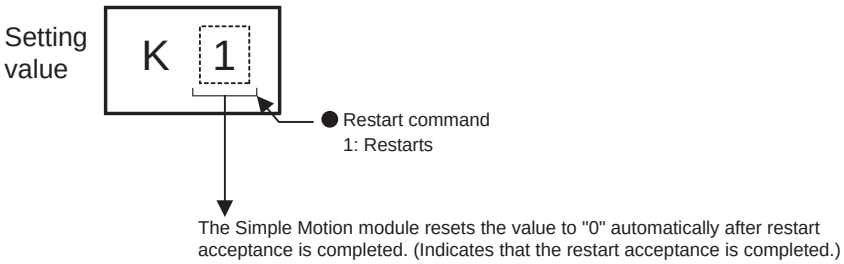
## [Cd.6] Restart command

- When "1" is set in [Cd.6] after the positioning is stopped for any reason (while the axis operation state is "stopped"), the positioning will be carried out again from the stop position to the end point of the stopped positioning data.

Fetch cycle: 14.2 [ms]

### ■Setting value

- Set with a decimal.


Setting value
K
1
Restart command
1: Restarts
The Simple Motion module resets the value to "0" automatically after restart acceptance is completed. (Indicates that the restart acceptance is completed.)

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 392 Control data

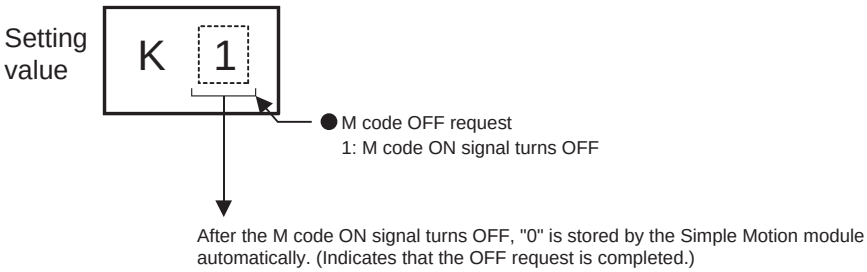
## [Cd.7] M code OFF request

- The M code ON signal turns OFF.

Fetch cycle: Operation cycle

### ■Setting value

- Set with a decimal.


Setting value
K
1
M code OFF request
1: M code ON signal turns OFF
After the M code ON signal turns OFF, "0" is stored by the Simple Motion module automatically. (Indicates that the OFF request is completed.)

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 392 Control data

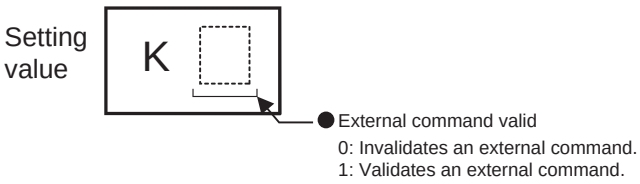
## [Cd.8] External command valid

- Validates or invalidates external command signals.

Fetch cycle: At request by external command signal

### ■Setting value

- Set with a decimal.




- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 392 Control data

## [Cd.9] New current value

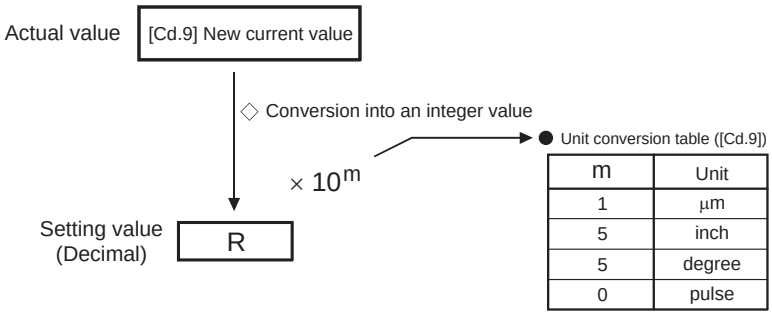
- When changing the "current feed value" using the start No. "9003", use this data item to specify a new feed value.
- Set a value within the following range:

| [Pr.1] Unit setting | mm ( × $10^{-1}$ μm) | inch ( × $10^{-5}$ inch) | degree ( × $10^{-5}$ degree) | pulse (pulse) |
|---|---|---|---|---|
| Setting range | -2147483648 to 2147483647 | -2147483648 to 2147483647 | 0 to 35999999 | -2147483648 to 2147483647 |

Fetch cycle: At change request

### ■Setting value

- Set with a decimal.




| m | Unit |
|---|---|
| 1 | μm |
| 5 | inch |
| 5 | degree |
| 0 | pulse |

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 392 Control data

## [Cd.10] New acceleration time value

- When changing the acceleration time during a speed change, use this data item to specify a new acceleration time.

| Setting range of [Cd.10] (unit) |
|---|
| 0 to 8388608 (ms) |

Fetch cycle: At change request

### ■Setting value

- Set with a decimal.

Setting value: [Cd.10] New acceleration time value / [Cd.11] New deceleration time value

Example: When the "[Cd.10] New acceleration time value" is set as "60000 ms", the buffer memory stores "60000".

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 392 Control data

## [Cd.11] New deceleration time value

• When changing the deceleration time during a speed change, use this data item to specify a new deceleration time.

| Setting range of [Cd.11] (unit) |
|---|
| 0 to 8388608 (ms) |

Fetch cycle: At change request

### ■Setting value

Refer to "[Cd.10] New acceleration time value".

☞ Page 513 [Cd.10] New acceleration time value

• Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 392 Control data

## [Cd.12] Accel/decel*1 time change value during speed change, enable/disable

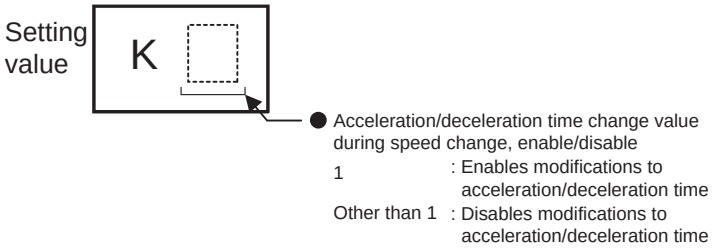
*1 "Accel/decel" is an abbreviation for "Acceleration/deceleration".

• Enables or disables modifications to the acceleration/deceleration time during a speed change.

Fetch cycle: At change request

### ■Setting value

• Set with a decimal.


Setting value
K
Acceleration/deceleration time change value during speed change, enable/disable
1 : Enables modifications to acceleration/deceleration time
Other than 1 : Disables modifications to acceleration/deceleration time

• Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 392 Control data

## [Cd.13] Positioning operation speed override

• To use the positioning operation speed override function, use this data item to specify an "override" value.

*1 For details of the override function, refer to the following.

☞ Page 254 Override function

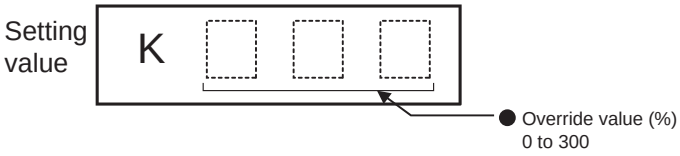
If the command speed is set to less than the minimum unit using the override function, the speed is raised to the minimum unit and the warning "Less than minimum speed" (warning code: 0904H) occurs.

If the override value "0 (%)" is set, the speed is set to "0" and the speed change 0 flag is set to "1". At the time, the warning "Less than minimum speed" (warning code: 0904H) does not occur.

Fetch cycle: Operation cycle

### ■Setting value

• Set with a decimal.




• Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 392 Control data

## [Cd.14] New speed value

- When changing the speed, use this data item to specify a new speed.
- The operation halts if you specify "0".
- Set a value within the following range:

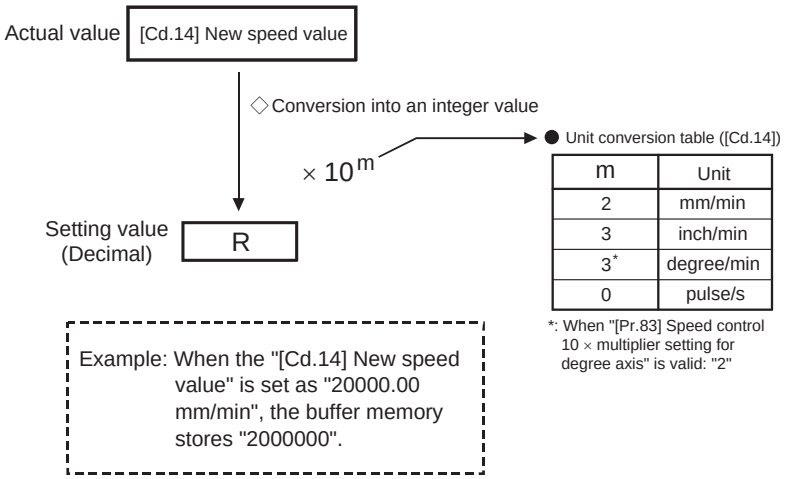
| [Pr.1] Unit setting | mm ( × $10^{-2}$ mm/min) | inch ( × $10^{-3}$ inch/min) | degree*1 ( × $10^{-3}$ degree/min) | pulse (pulse/s) |
|---|---|---|---|---|
| Setting range | 0 to 2000000000 | 0 to 2000000000 | 0 to 2000000000 | 0 to 1000000000 |

*1 When "[Pr.83] Speed control 10 × multiplier setting for degree axis" is valid, the setting range is 0 to 2000000000 ( × $10^{-2}$ degree/min).

Fetch cycle: At change request

### ■Setting value

- Set with a decimal.




- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 392 Control data

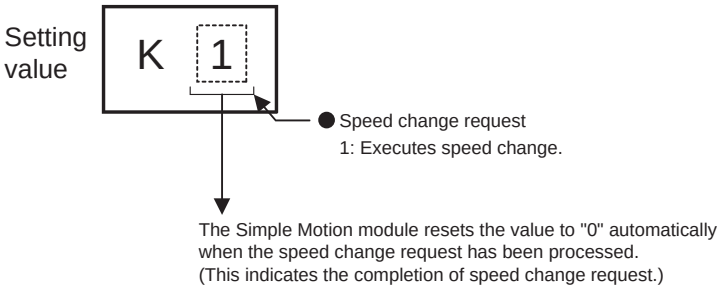
## [Cd.15] Speed change request

After setting the "[Cd.14] New speed value", set this data item to "1" to execute the speed change (through validating the new speed value).

Fetch cycle: Operation cycle

### ■Setting value

- Set with a decimal.


Setting value
K
1
● Speed change request
1: Executes speed change.
The Simple Motion module resets the value to "0" automatically when the speed change request has been processed.
(This indicates the completion of speed change request.)

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 392 Control data

## [Cd.16] Inching movement amount

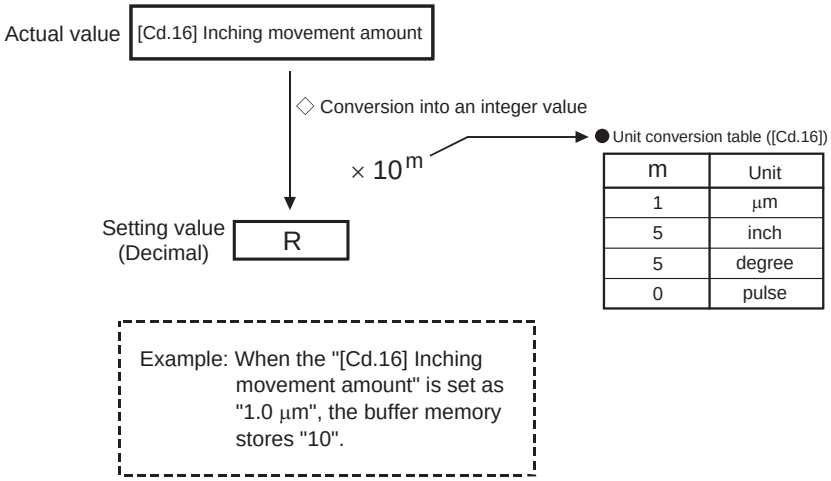
- Use this data item to set the amount of movement by inching.
- The machine performs a JOG operation if "0" is set.
- Set a value within the following range:

| [Pr.1] Unit setting | mm ( $\times 10^{-1}$ μm) | inch ( $\times 10^{-5}$ inch) | degree ( $\times 10^{-5}$ degree) | pulse (pulse) |
|---|---|---|---|---|
| Setting range | 0 to 65535 | 0 to 65535 | 0 to 65535 | 0 to 65535 |

Fetch cycle: At start

### ■Setting value

- Set with a decimal.


Actual value
[Cd.16] Inching movement amount
◇ Conversion into an integer value
× 10^m
● Unit conversion table ([Cd.16])
Setting value (Decimal)
R
Example: When the "[Cd.16] Inching movement amount" is set as "1.0 μm", the buffer memory stores "10".

| m | Unit |
|---|---|
| 1 | μm |
| 5 | inch |
| 5 | degree |
| 0 | pulse |

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 392 Control data

## [Cd.17] JOG speed

- Use this data item to set the JOG speed.
- Set a value within the following range:

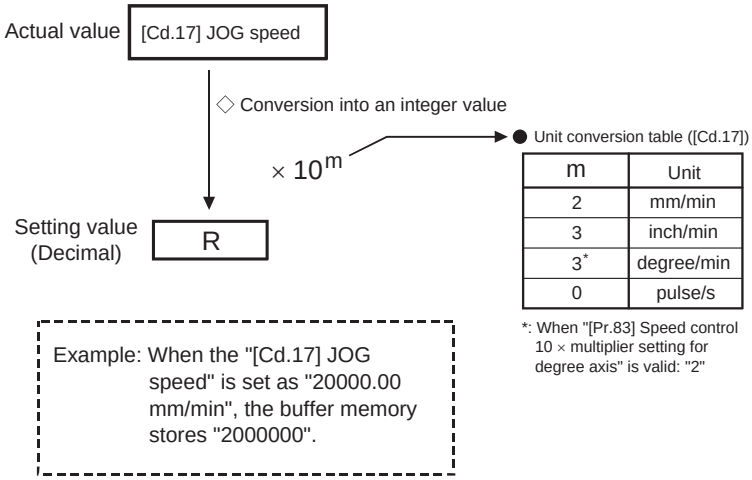
| [Pr.1] Unit setting | mm ( × $10^{-2}$ mm/min) | inch ( × $10^{-3}$ inch/min) | degree*1 ( × $10^{-3}$ degree/min) | pulse (pulse/s) |
|---|---|---|---|---|
| Setting range | 1 to 2000000000 | 1 to 2000000000 | 1 to 2000000000 | 1 to 1000000000 |

*1 When "[Pr.83] Speed control 10 × multiplier setting for degree axis" is valid, the setting range is 1 to 2000000000 ( × $10^{-2}$ degree/min).

Fetch cycle: At start

### ■Setting value

- Set with a decimal.


Actual value
[Cd.17] JOG speed
◇ Conversion into an integer value
× 10m
Setting value (Decimal)
R
Example: When the "[Cd.17] JOG speed" is set as "20000.00 mm/min", the buffer memory stores "2000000".

● Unit conversion table ([Cd.17])

| m | Unit |
|---|---|
| 2 | mm/min |
| 3 | inch/min |
| 3* | degree/min |
| 0 | pulse/s |

*: When "[Pr.83] Speed control 10 × multiplier setting for degree axis" is valid: "2"

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 392 Control data

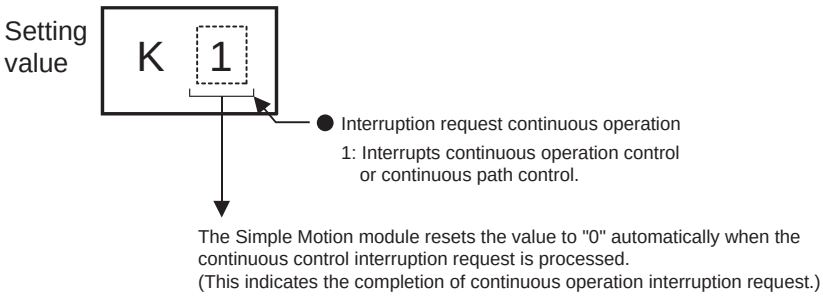
## [Cd.18] Interrupt request during continuous operation

- To interrupt a continuous operation, set "1" to this data item.
- After processing the interruption request ("1"), the Simple Motion module automatically resets the value to "0".

Fetch cycle: Operation cycle

### ■Setting value

- Set with a decimal.


Setting value
K
1
● Interruption request continuous operation
1: Interrupts continuous operation control or continuous path control.
The Simple Motion module resets the value to "0" automatically when the continuous control interruption request is processed.
(This indicates the completion of continuous operation interruption request.)

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 392 Control data

## [Cd.19] Home position return request flag OFF request

• The program can use this data item to forcibly turn the home position return request flag from ON to OFF.

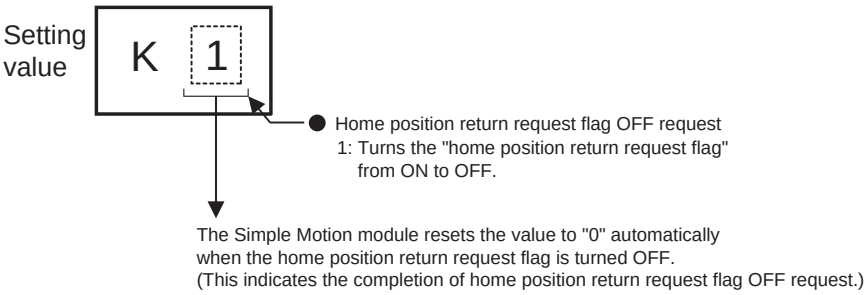
Fetch cycle: 14.2 [ms]

**Point**

This parameter is made valid when the increment system is valid.

### ■Setting value

• Set with a decimal.


Setting value
K
1
Home position return request flag OFF request
1: Turns the "home position return request flag" from ON to OFF.
The Simple Motion module resets the value to "0" automatically when the home position return request flag is turned OFF.
(This indicates the completion of home position return request flag OFF request.)

• Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 392 Control data

## [Cd.20] Manual pulse generator 1 pulse input magnification

• This data item determines the factor by which the number of pulses from the manual pulse generator is magnified.

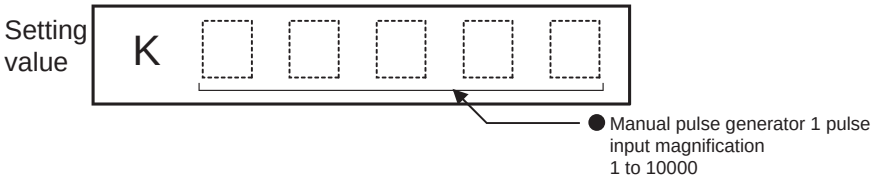
• Value "0": read as "1".

• Value "10001 or more" or negative value: read as "10000".

Fetch cycle: Operation cycle (At manual pulse generator enabled)

### ■Setting value

• Set with a decimal.




• Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 392 Control data

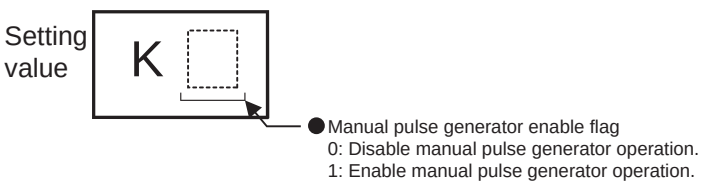
## [Cd.21] Manual pulse generator enable flag

• This data item enables or disables operations using a manual pulse generator.

Fetch cycle: Operation cycle

### ■Setting value

• Set with a decimal.


Setting value
K
Manual pulse generator enable flag
0: Disable manual pulse generator operation.
1: Enable manual pulse generator operation.

• Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 392 Control data

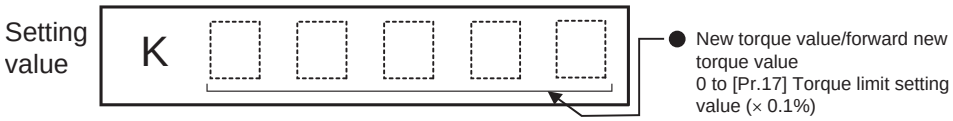
## [Cd.22] New torque value/forward new torque value

- When "0" is set to "[Cd.112] Torque change function switching request", a new torque limit value is set. (This value is set to the forward torque limit value and reverse torque limit value.) When "1" is set to "[Cd.112] Torque change function switching request", a new forward torque limit value is set.
- Set a value within "0" to "[Pr.17] Torque limit setting value". Set a ratio against the rated torque in 0.1% unit. (The new torque value is invalid when "0" is set, and "[Pr.17] Torque limit setting value" or "[Cd.101] Torque output setting value" becomes valid. The range of torque change is 1 to "[Pr.17] Torque limit setting value".)

Fetch cycle: Operation cycle

### ■Setting value

- Set with a decimal.




- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 392 Control data

## [Cd.23] Speed-position switching control movement amount change register

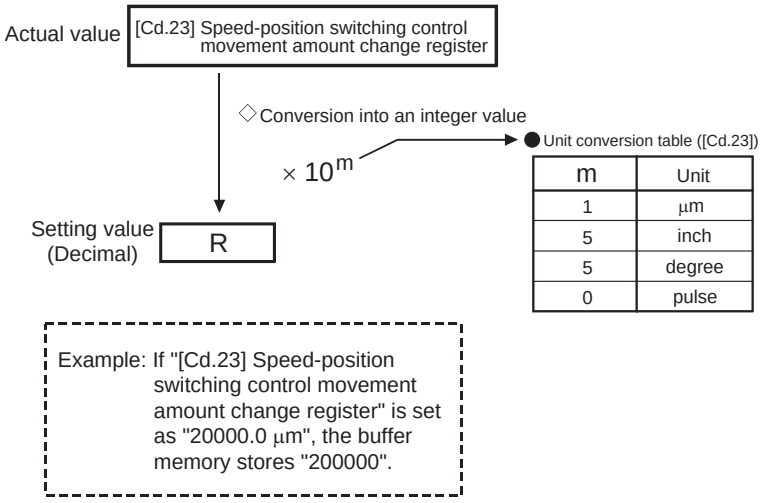
- During the speed control stage of the speed-position switching control (INC mode), it is possible to change the specification of the movement amount during the position control stage. For that, use this data item to specify a new movement amount.
- The new movement amount has to be set during the speed control stage of the speed-position switching control (INC mode).
- The value is reset to "0" when the next operation starts.
- Set a value within the following range:

| [Pr.1] Unit setting | mm ( × $10^{-1}$ μm) | inch ( × $10^{-5}$ inch) | degree ( × $10^{-5}$ degree) | pulse (pulse) |
|---|---|---|---|---|
| Setting range | 0 to 2147483647 | 0 to 2147483647 | 0 to 2147483647 | 0 to 2147483647 |

Fetch cycle: At switching request

### ■Setting value

- Set with a decimal.




Example: If "[Cd.23] Speed-position switching control movement amount change register" is set as "20000.0 μm", the buffer memory stores "200000".

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 392 Control data

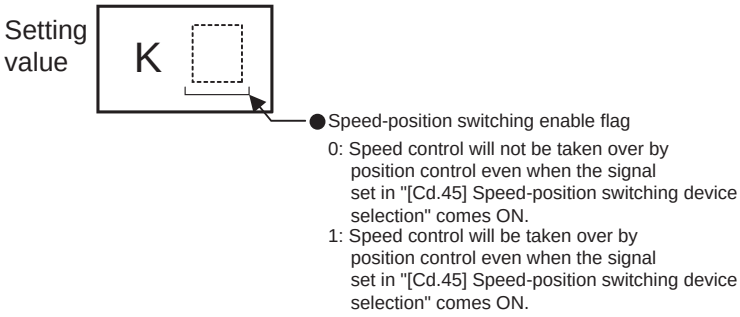
## [Cd.24] Speed-position switching enable flag

• Sets whether the switching signal set in "[Cd.45] Speed-position switching device selection" is enabled or not.

Fetch cycle: At switching request

### ■Setting value

• Set with a decimal.


Setting value
K
Speed-position switching enable flag
0: Speed control will not be taken over by position control even when the signal set in "[Cd.45] Speed-position switching device selection" comes ON.
1: Speed control will be taken over by position control even when the signal set in "[Cd.45] Speed-position switching device selection" comes ON.

• Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 392 Control data

## [Cd.25] Position-speed switching control speed change register

• During the position control stage of the position-speed switching control, it is possible to change the specification of the speed during the speed control stage. For that, use this data item to specify a new speed.

• The new speed has to be set during the position control stage of the position-speed switching control.

• The value is reset to "0" when the next operation starts.

• Set a value within the following range:

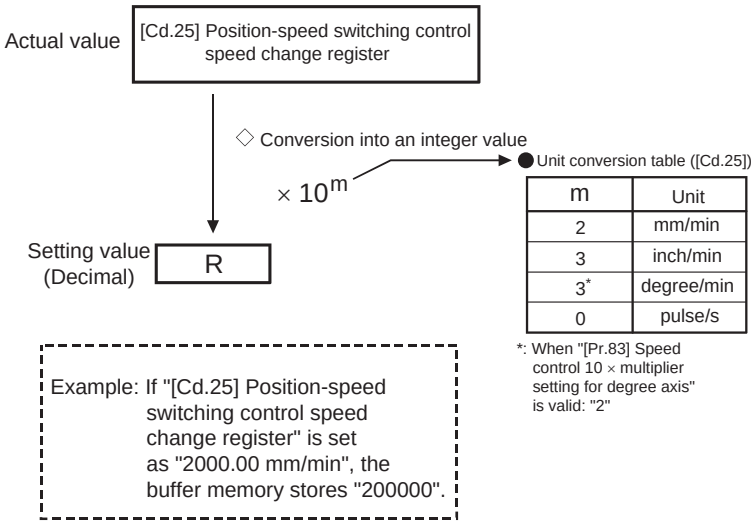
| [Pr.1] Unit setting | mm ( × $10^{-2}$ mm/min) | inch ( × $10^{-3}$ inch/min) | degree*1 ( × $10^{-3}$ degree/min) | pulse (pulse/s) |
|---|---|---|---|---|
| Setting range | 0 to 2000000000 | 0 to 2000000000 | 0 to 2000000000 | 0 to 1000000000 |

*1 When "[Pr.83] Speed control 10 × multiplier setting for degree axis" is valid, the setting range is 0 to 2000000000 ( × $10^{-2}$ degree/min).

Fetch cycle: At switching request

### ■Setting value

• Set with a decimal.


Actual value
[Cd.25] Position-speed switching control speed change register
◇ Conversion into an integer value
× 10^m
Unit conversion table ([Cd.25])
m | Unit
2 | mm/min
3 | inch/min
3* | degree/min
0 | pulse/s
*: When "[Pr.83] Speed control 10 × multiplier setting for degree axis" is valid: "2"
Setting value (Decimal)
R
Example: If "[Cd.25] Position-speed switching control speed change register" is set as "2000.00 mm/min", the buffer memory stores "200000".

• Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 392 Control data

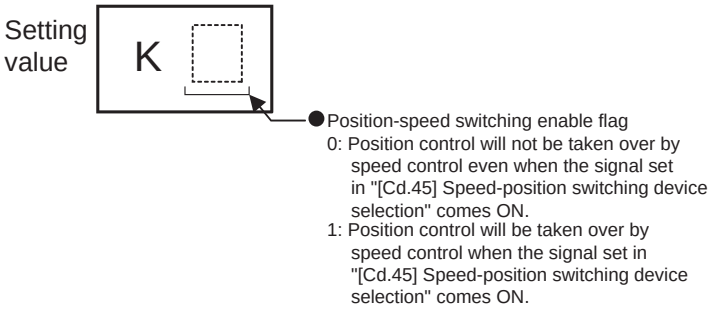
## [Cd.26] Position-speed switching enable flag

• Sets whether the switching signal set in "[Cd.45] Speed-position switching device selection" is enabled or not.

Fetch cycle: At switching request

### ■Setting value

• Set with a decimal.


Setting value
K
Position-speed switching enable flag
0: Position control will not be taken over by speed control even when the signal set in "[Cd.45] Speed-position switching device selection" comes ON.
1: Position control will be taken over by speed control when the signal set in "[Cd.45] Speed-position switching device selection" comes ON.

• Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 392 Control data

## [Cd.27] Target position change value (New address)

• When changing the target position during a positioning operation, use this data item to specify a new positioning address.

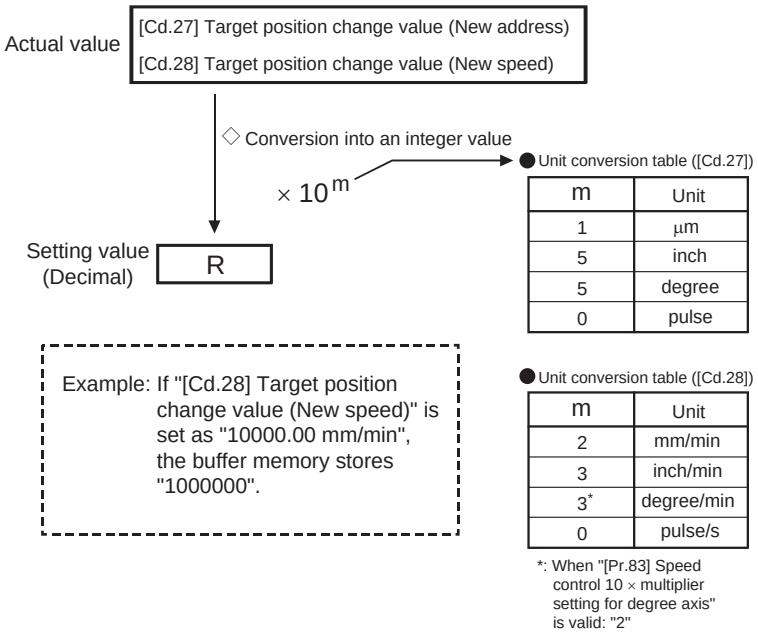
• Set a value within the following range:

| [Pr.1] Unit setting | mm ( × $10^{-1}$ μm) | inch ( × $10^{-5}$ inch) | degree ( × $10^{-5}$ degree) | pulse (pulse) |
|---|---|---|---|---|
| ABS | -2147483648 to 2147483647 | -2147483648 to 2147483647 | 0 to 35999999 | -2147483648 to 2147483647 |
| INC | -2147483648 to 2147483647 | -2147483648 to 2147483647 | -2147483648 to 2147483647 | -2147483648 to 2147483647 |

Fetch cycle: At change request

### ■Setting value

• Set with a decimal.


Actual value
[Cd.27] Target position change value (New address)
[Cd.28] Target position change value (New speed)
◇ Conversion into an integer value
× 10^m
Setting value (Decimal)
R
Example: If "[Cd.28] Target position change value (New speed)" is set as "10000.00 mm/min", the buffer memory stores "1000000".
Unit conversion table ([Cd.27])
m | Unit
1 | μm
5 | inch
5 | degree
0 | pulse
Unit conversion table ([Cd.28])
m | Unit
2 | mm/min
3 | inch/min
3* | degree/min
0 | pulse/s
*: When "[Pr.83] Speed control 10 × multiplier setting for degree axis" is valid: "2"

• Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 392 Control data

## [Cd.28] Target position change value (New speed)

- When changing the target position during a positioning operation, use this data item to specify a new speed.
- The speed will not change if "0" is set.
- Set a value within the following range:

| [Pr.1] Unit setting | mm ( × $10^{-2}$ mm/min) | inch ( × $10^{-3}$ inch/min) | degree*1 ( × $10^{-3}$ degree/min) | pulse (pulse/s) |
|---|---|---|---|---|
| Setting range | 0 to 2000000000 | 0 to 2000000000 | 0 to 2000000000 | 0 to 1000000000 |

*1 When "[Pr.83] Speed control 10 × multiplier setting for degree axis" is valid, the setting range is 0 to 2000000000 ( × $10^{-2}$ degree/min).

Fetch cycle: At change request

### ■Setting value

Refer to "[Cd.27] Target position change value (New address)".

☞ Page 521 [Cd.27] Target position change value (New address)

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 392 Control data

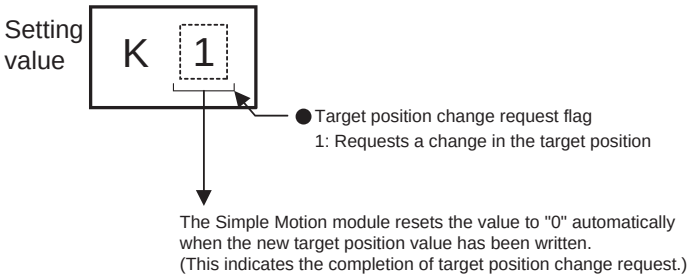
## [Cd.29] Target position change request flag

- Requests a change in the target position during a positioning operation.

Fetch cycle: Operation cycle

### ■Setting value

- Set with a decimal.


Setting value
K
1
Target position change request flag
1: Requests a change in the target position
The Simple Motion module resets the value to "0" automatically when the new target position value has been written.
(This indicates the completion of target position change request.)

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 392 Control data

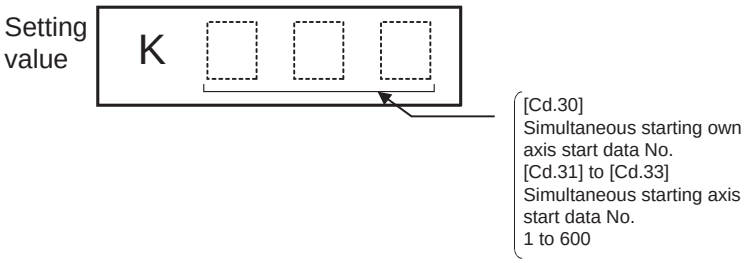
## [Cd.30] Simultaneous starting own axis start data No.

- Use this data item to specify a start data No. of own axis at multiple axes simultaneous starting.

Fetch cycle: At start

### ■Setting value

- Set with a decimal.




- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 392 Control data

## [Cd.31] Simultaneous starting axis start data No.1

• Use this data item to specify a start data No.1 for each axis that starts simultaneously.

Fetch cycle: At start

### ■Setting value

Refer to "[Cd.30] Simultaneous starting own axis start data No.".

☞ Page 522 [Cd.30] Simultaneous starting own axis start data No.

• Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 392 Control data

## [Cd.32] Simultaneous starting axis start data No.2

• Use this data item to specify a start data No.2 for each axis that starts simultaneously.

*1 For 2 axis simultaneous starting, the axis setting is not required. (Setting value is ignored.)

Fetch cycle: At start

### ■Setting value

Refer to "[Cd.30] Simultaneous starting own axis start data No.".

☞ Page 522 [Cd.30] Simultaneous starting own axis start data No.

• Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 392 Control data

## [Cd.33] Simultaneous starting axis start data No.3

• Use this data item to specify a start data No.3 for each axis that starts simultaneously.

*1 For 2 axis simultaneous starting and 3 axis simultaneous starting, the axis setting is not required. (Setting value is ignored.)

Fetch cycle: At start

### ■Setting value

Refer to "[Cd.30] Simultaneous starting own axis start data No.".

☞ Page 522 [Cd.30] Simultaneous starting own axis start data No.

• Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 392 Control data

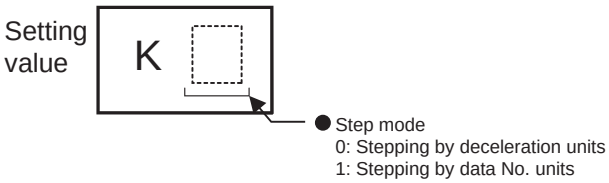
## [Cd.34] Step mode

• To perform a step operation, use this data item to specify the units by which the stepping should be performed.

Fetch cycle: At start

### ■Setting value

• Set with a decimal.




• Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 392 Control data

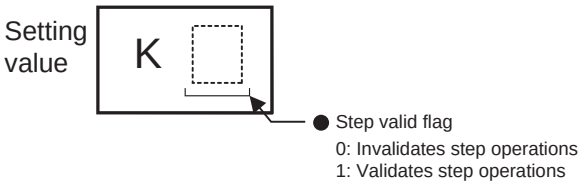
## [Cd.35] Step valid flag

• This data item validates or invalidates step operations.

Fetch cycle: At start

### ■Setting value

• Set with a decimal.




• Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 392 Control data

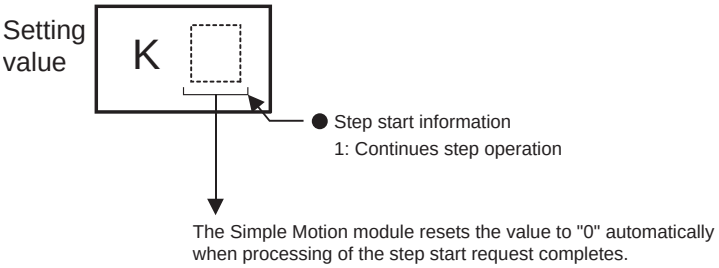
## [Cd.36] Step start information

• To continue the step operation when the step function is used, set "1" in the data item.

Fetch cycle: 14.2 [ms]

### ■Setting value

• Set with a decimal.


Setting value
K
Step start information
1: Continues step operation
The Simple Motion module resets the value to "0" automatically when processing of the step start request completes.

• Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 392 Control data

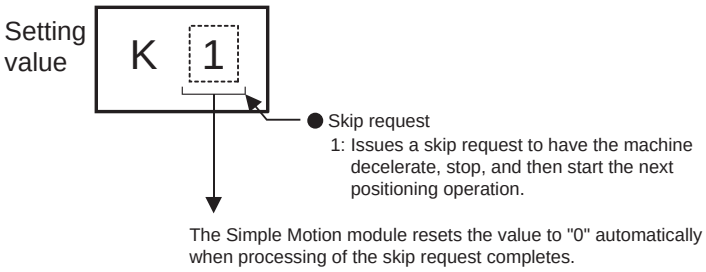
## [Cd.37] Skip command

• To skip the current positioning operation, set "1" in this data item.

Fetch cycle: Operation cycle (During positioning operation)

### ■Setting value

• Set with a decimal.


Setting value
K
1
Skip request
1: Issues a skip request to have the machine decelerate, stop, and then start the next positioning operation.
The Simple Motion module resets the value to "0" automatically when processing of the skip request completes.

• Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 392 Control data

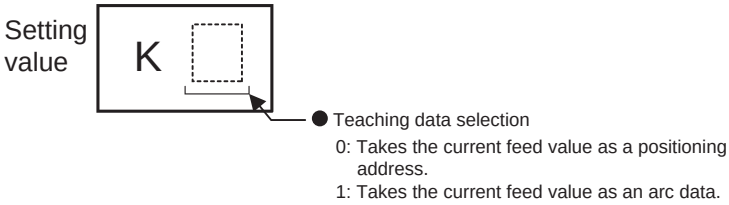
## [Cd.38] Teaching data selection

- This data item specifies the teaching result write destination.
- Data are cleared to zero when the teaching ends.

Fetch cycle: At operation request

### ■Setting value

- Set with a decimal.


Setting value
K
Teaching data selection
0: Takes the current feed value as a positioning address.
1: Takes the current feed value as an arc data.

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 392 Control data

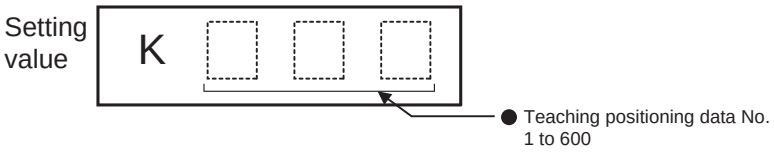
## [Cd.39] Teaching positioning data No.

- This data item specifies data to be produced by teaching.
- If a value between 1 and 600 is set, a teaching operation is done.
- The value is cleared to "0" when the Simple Motion module is initialized, when a teaching operation completes, and when an illegal value (601 or higher) is entered.

Fetch cycle: 103 [ms]

### ■Setting value

- Set with a decimal.




- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 392 Control data

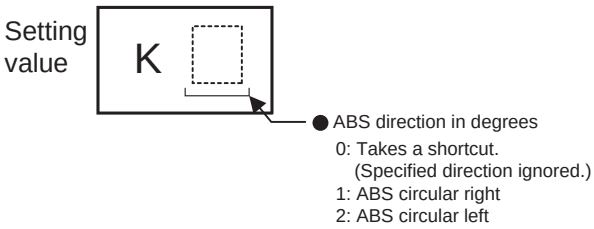
## [Cd.40] ABS direction in degrees

- This data item specifies the ABS moving direction carrying out the position control when "degree" is selected as the unit.

Fetch cycle: At start

### ■Setting value

- Set with a decimal.




- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 392 Control data

## [Cd.43] Simultaneous starting axis

- Set the number of simultaneous starting axes and target axis. When "2" is set to the number of simultaneous starting axes, set the target axis No. to the simultaneous starting axis No. 1. When "3" is set to the number of simultaneous starting axes, set the target axis No. to the simultaneous starting axis No.1 and 2. When "4" is set to the number of simultaneous starting axes, set the target axis No. to the simultaneous starting axis No.1 to 3.
- When the same axis No. or axis No. of own axis is set to the multiple simultaneous starting axis No, or the value outside the range is set to the number of simultaneous starting axes, the error "Error before simultaneous start" (error code: 1990H, 1991H) occurs and the operation is not executed.

**Point**

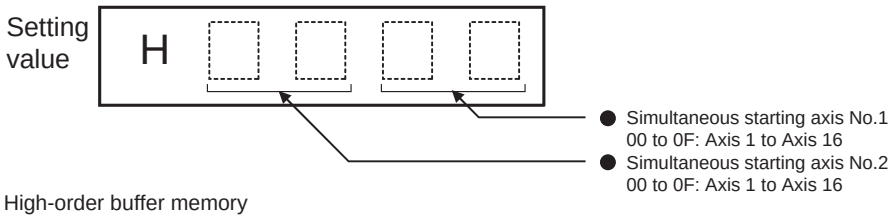
Do not set the simultaneous starting axis No.2 and 3 for 2-axis interpolation, and do not set the simultaneous starting axis No.3 for 3-axis interpolation. The setting value is ignored.

Fetch cycle: At start

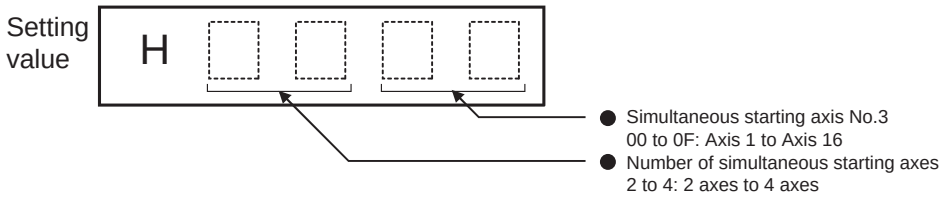
### ■Setting value

- Set with a hexadecimal.

• Low-order buffer memory


Setting value
H
Simultaneous starting axis No.1
00 to 0F: Axis 1 to Axis 16
Simultaneous starting axis No.2
00 to 0F: Axis 1 to Axis 16

• High-order buffer memory


Setting value
H
Simultaneous starting axis No.3
00 to 0F: Axis 1 to Axis 16
Number of simultaneous starting axes
2 to 4: 2 axes to 4 axes

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 392 Control data

## [Cd.45] Speed-position switching device selection

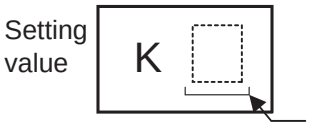
- Select the device used for speed-position switching.

*1 If the setting is outside the range at start, operation is performed with the setting regarded as "0".

Fetch cycle: At positioning start for speed-position switching control/position-speed switching control

### ■Setting value

- Set with a decimal.




●Speed-position switching device selection
<Speed-position switching control>
0: Use the external command signal for switching from speed control to position control
1: Use the near-point dog signal for switching from speed control to position control
2: Use "[Cd.46] Speed-position switching command" for switching from speed control to position control
<Position-speed switching control>
0: Use the external command signal for switching from position control to speed control
1: Use the near-point dog signal for switching from position control to speed control
2: Use "[Cd.46] Speed-position switching command" for switching from position control to speed control

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 392 Control data

## [Cd.46] Speed-position switching command

- Speed-position control switching is performed when "2" is set in "[Cd.45] Speed-position switching device selection". Other than setting value is ignored.

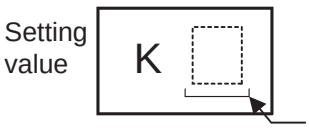
**Point**

This parameter is made valid only when "2" is set in "[Cd.45] Speed-position switching device selection" at start.

Fetch cycle: 0.88 [ms]

### ■Setting value

- Set with a decimal.




● Speed-position switching command
<Speed-position switching control>
0: Not switch from speed control to position control
1: Switch from speed control to position control
<Position-speed switching control>
0: Not switch from position control to speed control
1: Switch from position control to speed control

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 392 Control data

## [Cd.100] Servo OFF command

• Executes servo OFF for each axis.

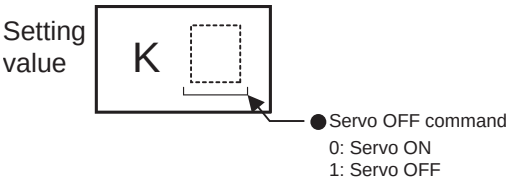
Fetch cycle: Operation cycle

**Point**

To execute servo ON for axes other than axis 1 being servo OFF, write "1" to storage buffer memory address of axis 1 and then turn ON all axis servo ON [Y1] signal.

### ■Setting value

• Set with a decimal.




Valid only during servo ON for all axes.

• Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 392 Control data

## [Cd.101] Torque output setting value

• Sets the torque output value. Set a ratio against the rated torque in 0.1% unit.

Fetch cycle: At start

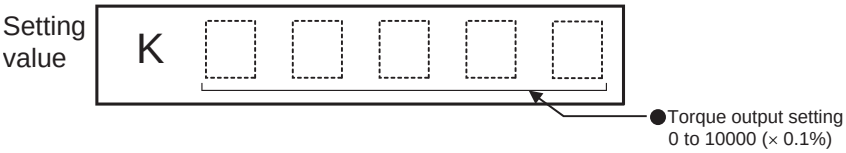
**Point**

- If the "[Cd.101] Torque output setting value" is "0", the "[Pr.17] Torque limit setting value" will be its value.
- If a value beside "0" is set in the "[Cd.101] Torque output setting value", the torque generated by the servomotor will be limited by that value.
- The "[Pr.17] Torque limit setting value" of the detailed parameter becomes effective at the PLC ready signal leading edge.
- The "[Cd.101] Torque output setting value" (refer to the start) axis control data can be changed at all times. Therefore in the "[Cd.101] Torque output setting value" is used when you must change.

(☞ Page 259 Torque change function)

### ■Setting value

• Set with a decimal.




• Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 392 Control data

## [Cd.108] Gain changing command flag

• The command required to carry out "gain changing" of the servo amplifier from the Simple Motion module.

Fetch cycle: Operation cycle

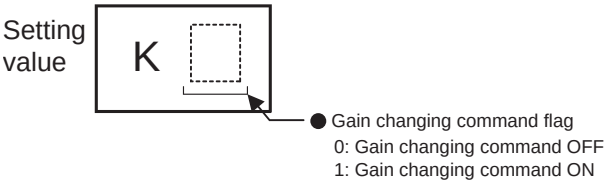
**Point**

If the setting is other than "0" and "1", operation is performed in the "gain changing" with the setting regard as "0".

Refer to each servo amplifier instruction manual.

### ■Setting value

• Set with a decimal.




• Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 392 Control data

## [Cd.112] Torque change function switching request

• Sets "same setting/individual setting" of the forward torque limit value or reverse torque limit value in the torque change function.

Fetch cycle: Operation cycle

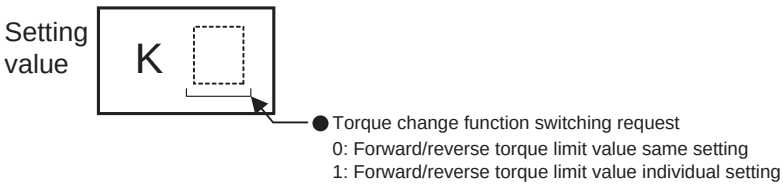
**Point**

• Set "0" normally. (when the forward torque limit value and reverse torque limit value are not divided.)

• When a value except "1" is set, it operates as "forward/reverse torque limit value same setting".

### ■Setting value

• Set with a decimal.


Setting value
K
Torque change function switching request
0: Forward/reverse torque limit value same setting
1: Forward/reverse torque limit value individual setting

• Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 392 Control data

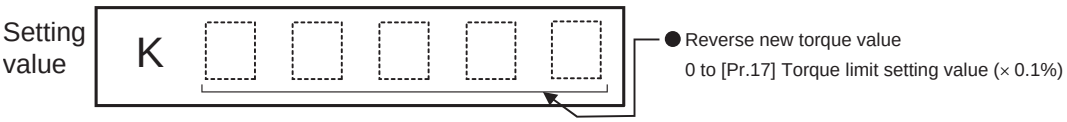
## [Cd.113] Reverse new torque value

- "1" is set in "[Cd.112] Torque change function switching request", a new reverse torque limit value is set. (when "0" is set in "[Cd.112] Torque change function switching request", the setting value is invalid.)
- Set a value within "0" to "[Pr.17] Torque limit setting value". Set a ratio against the rated torque in 0.1% unit. (The new torque value is invalid when "0" is set, and "[Pr.17] Torque limit setting value" or "[Cd.101] Torque output setting value" becomes valid. The range of torque change is 1 to "[Pr.17] Torque limit setting value".

Fetch cycle: Operation cycle

### ■Setting value

- Set with a decimal.




- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 392 Control data

## [Cd.130] Servo parameter write request

- Set the write request of servo parameter. Set "1" or "2" after setting "[Cd.131] Parameter No. (Setting for servo parameters to be changed)" and "[Cd.132] Change data".

Fetch cycle: Main cycle*1

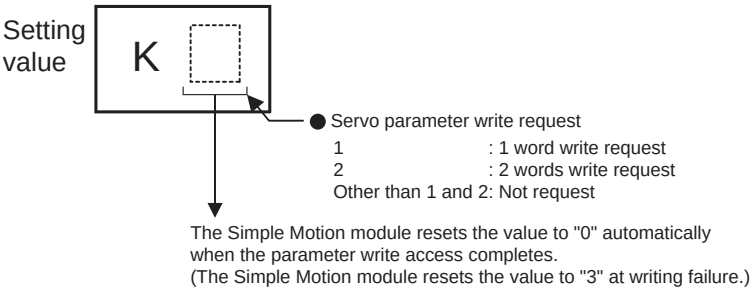
*1 Cycle of processing executed at free time except for the positioning control. It changes by status of axis start.

### ■Setting value

- Set with a decimal.

Set "1" for MR-J4(W)-B, MR-JE-B, and MR-J3(W)-B, and set "2" for VCⅡ series.

Writing failure occurs when a value except "1" or "2" is set.


Setting value
K
Servo parameter write request
1 : 1 word write request
2 : 2 words write request
Other than 1 and 2: Not request
The Simple Motion module resets the value to "0" automatically when the parameter write access completes.
(The Simple Motion module resets the value to "3" at writing failure.)

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 392 Control data

## [Cd.131] Parameter No. (Setting for servo parameters to be changed)

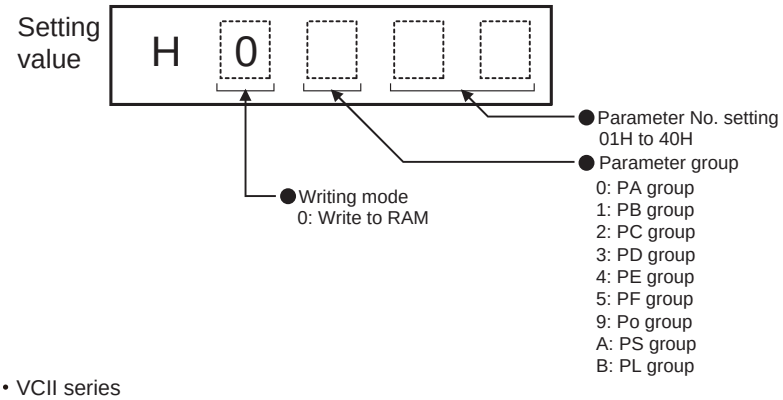
• Set the servo parameter to be changed.

Fetch cycle: At change request

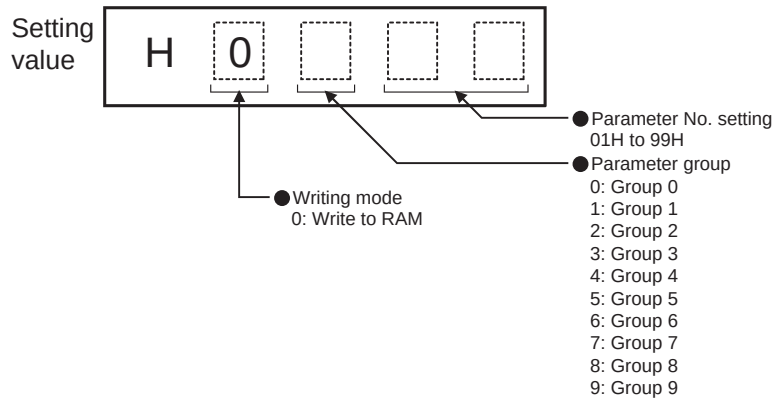
### ■Setting value

• Set with a hexadecimal.

• MR-J4(W)-B/MR-JE-B




• VCII series




• Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 392 Control data

## [Cd.132] Change data

• Set the change value of servo parameter set in "[Cd.131] Parameter No. (Setting for servo parameters to be changed)".

Fetch cycle: At change request

### ■Setting value

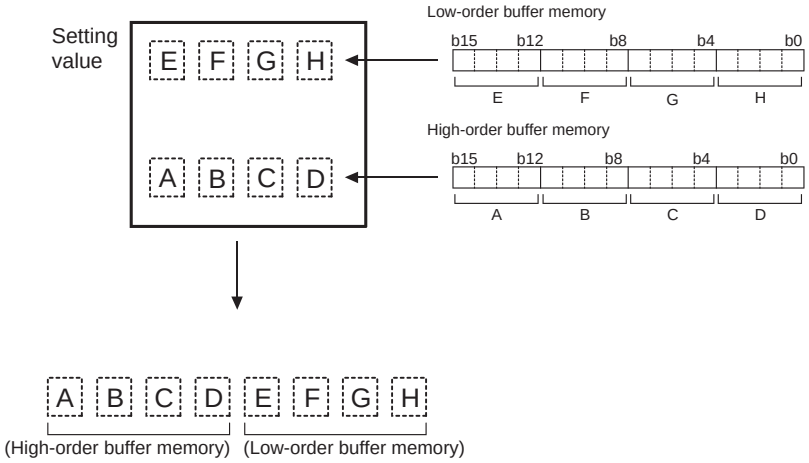
• Set with a decimal or hexadecimal.

[1 word write request]

When "1" is set in "[Cd.130] Servo parameter write request", set the change value to low-order buffer memory. The value set to high-order buffer memory is invalid.

[2 words write request]

When "2" is set in "[Cd.130] Servo parameter write request", set the change value to high-order buffer memory and low-order buffer memory.




• Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 392 Control data

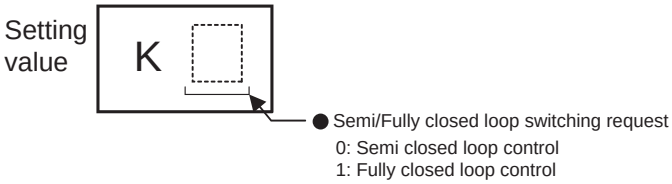
## [Cd.133] Semi/Fully closed loop switching request

• Set the switching of semi closed control and fully closed control.

Fetch cycle: Operation cycle (Fully closed loop control servo amplifier only)

### ■Setting value

• Set with a decimal.




• Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 392 Control data

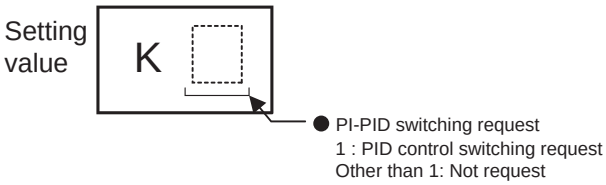
## [Cd.136] PI-PID switching request

• Set the PI-PID switching to servo amplifier.

Fetch cycle: Operation cycle

### ■Setting value

• Set with a decimal




• Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 392 Control data

## [Cd.138] Control mode switching request

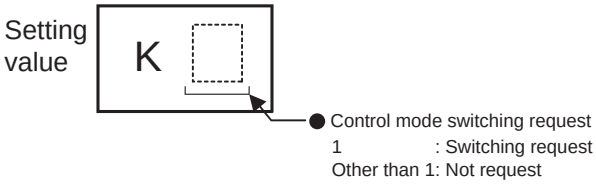
• Request the control mode switching. Set "1" after setting "[Cd.139] Control mode setting".

• The Simple Motion module sets "0" at completion of control mode switching.

Fetch cycle: Operation cycle

### ■Setting value

• Set with a decimal.




• Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 392 Control data

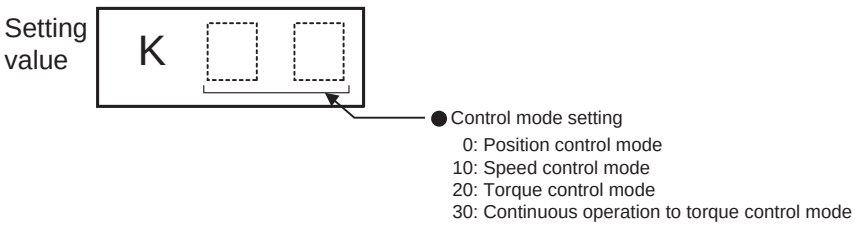
## [Cd.139] Control mode setting

• Set the control mode to be changed in the speed-torque control.

Fetch cycle: At control mode switching

### ■Setting value

• Set with a decimal.




• Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 392 Control data

## [Cd.140] Command speed at speed control mode

- Set the command speed at speed control mode.
- Set a value within the following range:

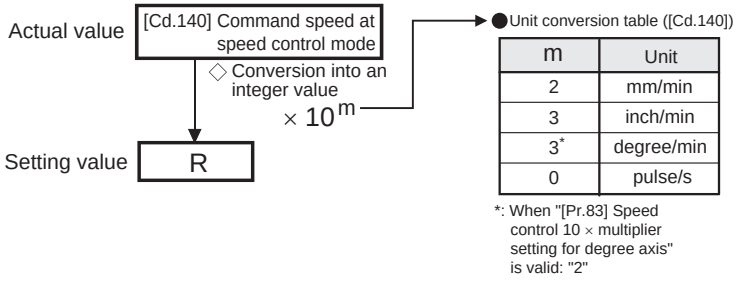
| [Pr.1] Unit setting | mm ( × $10^{-2}$ mm/min) | inch ( × $10^{-3}$ inch/min) | degree*1 ( × $10^{-3}$ degree/min) | pulse (pulse/s) |
|---|---|---|---|---|
| Setting range | -2000000000 to 2000000000 | -2000000000 to 2000000000 | -2000000000 to 2000000000 | -1000000000 to 1000000000 |

*1 When "[Pr.83] Speed control 10 × multiplier setting for degree axis" is valid, the setting range is -2000000000 to 2000000000 ( × $10^{-2}$ degree/min).

Fetch cycle: Operation cycle (At speed control mode)

### ■Setting value

- Set with a decimal.




- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 392 Control data

## [Cd.141] Acceleration time at speed control mode

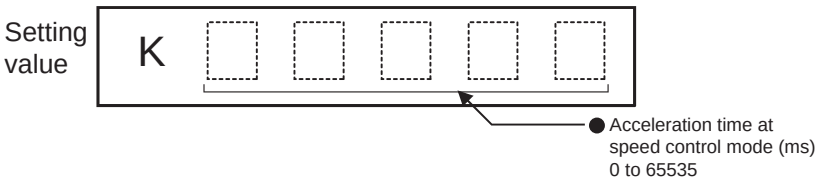
- Set the acceleration time at speed control mode. (Set the time for the speed to increase from "0" to "[Pr.8] Speed limit value".)

0 to 65535 (ms)

Fetch cycle: At control mode switching

### ■Setting value

- Set with a decimal.




- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 392 Control data

## [Cd.142] Deceleration time at speed control mode

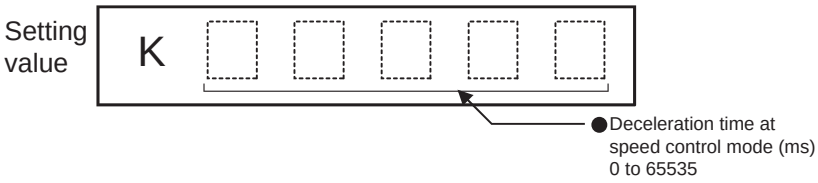
• Set the deceleration time at speed control mode. (Set the time for the speed to decrease from "[Pr.8] Speed limit value" to "0".)

0 to 65535 (ms)

Fetch cycle: At control mode switching

### ■Setting value

• Set with a decimal.




• Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 392 Control data

## [Cd.143] Command torque at torque control mode

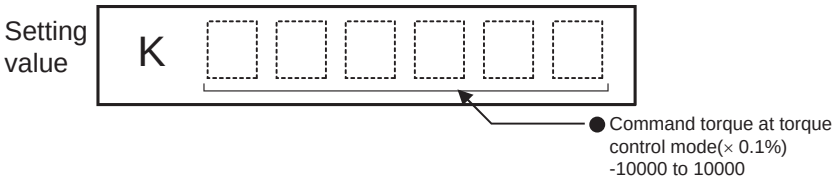
• Set the command torque at torque control mode. Set a ratio against the rated torque in 0.1% unit.

-10000 to 10000 ( × 0.1%)

Fetch cycle: Operation cycle (At torque control mode)

### ■Setting value

• Set with a decimal.




• Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 392 Control data

## [Cd.144] Torque time constant at torque control mode (Forward direction)

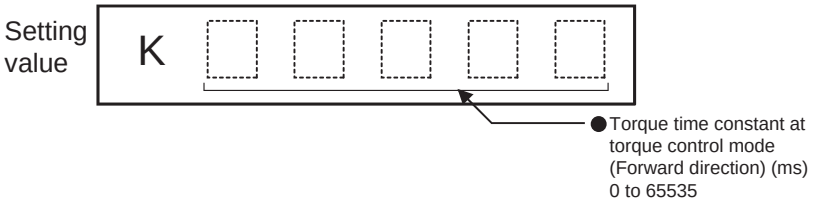
• Set the time constant at driving during torque control mode. (Set the time for the torque to increase from "0" to "[Pr.17] Torque limit setting value".)

0 to 65535 (ms)

Fetch cycle: At control mode switching

### ■Setting value

• Set with a decimal.




• Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 392 Control data

## [Cd.145] Torque time constant at torque control mode (Negative direction)

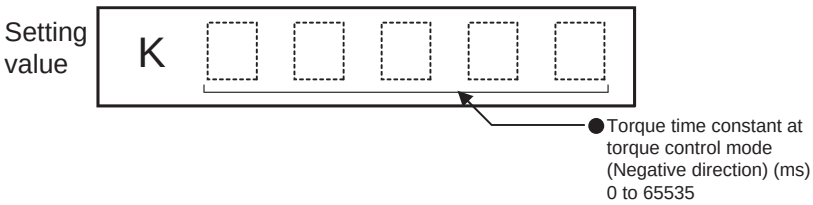
- Set the time constant at regeneration during torque control mode. (Set the time for the torque to decrease from "[Pr.17] Torque limit setting value" to "0".)

0 to 65535 (ms)

Fetch cycle: At control mode switching

### ■Setting value

- Set with a decimal.




- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 392 Control data

## [Cd.146] Speed limit value at torque control mode

- Set the speed limit value at torque control mode.
- Set a value within the following range:

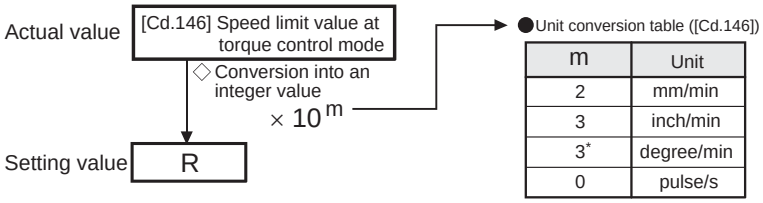
| [Pr.1] Unit setting | mm ( × $10^{-2}$ mm/min) | inch ( × $10^{-3}$ inch/min) | degree*1 ( × $10^{-3}$ degree/min) | pulse (pulse/s) |
|---|---|---|---|---|
| Setting range | 0 to 2000000000 | 0 to 2000000000 | 0 to 2000000000 | 0 to 1000000000 |

*1 When "[Pr.83] Speed control 10 × multiplier setting for degree axis" is valid, the setting range is 0 to 2000000000 ( × $10^{-2}$ degree/min).

Fetch cycle: Operation cycle (At torque control mode)

### ■Setting value

- Set with a decimal.




●Unit conversion table ([Cd.146])

| m | Unit |
|---|---|
| 2 | mm/min |
| 3 | inch/min |
| 3* | degree/min |
| 0 | pulse/s |

*: When "[Pr.83] Speed control 10 × multiplier setting for degree axis" is valid: "2"

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 392 Control data

## [Cd.147] Speed limit value at continuous operation to torque control mode

- Set the speed limit value at continuous operation to torque control mode.
- Set a value within the following range:

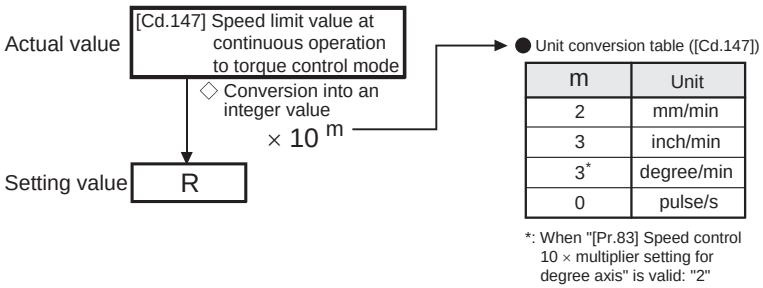
| [Pr.1] Unit setting | mm ( × $10^{-2}$ mm/min) | inch ( × $10^{-3}$ inch/min) | degree*1 ( × $10^{-3}$ degree/min) | pulse (pulse/s) |
|---|---|---|---|---|
| Setting range | -2000000000 to 2000000000 | -2000000000 to 2000000000 | -2000000000 to 2000000000 | -1000000000 to 1000000000 |

*1 When "[Pr.83] Speed control 10 × multiplier setting for degree axis" is valid, the setting range is -2000000000 to 2000000000 ( × $10^{-2}$ degree/min).

Fetch cycle: Operation cycle (At continuous operation to torque control mode)

### ■Setting value

- Set with a decimal.




- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 392 Control data

## [Cd.148] Acceleration time at continuous operation to torque control mode

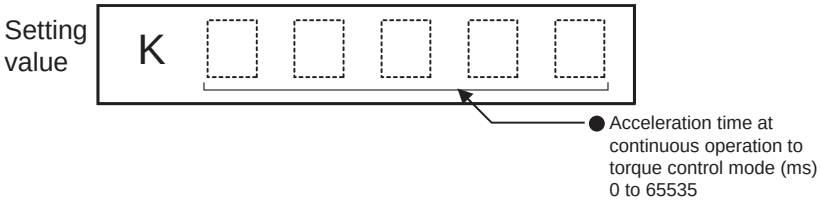
- Set the acceleration time at continuous operation to torque control mode. (Set the time for the speed to increase from "0" to "[Pr.8] Speed limit value".)

0 to 65535 (ms)

Fetch cycle: At control mode switching

### ■Setting value

- Set with a decimal.




- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 392 Control data

## [Cd.149] Deceleration time at continuous operation to torque control mode

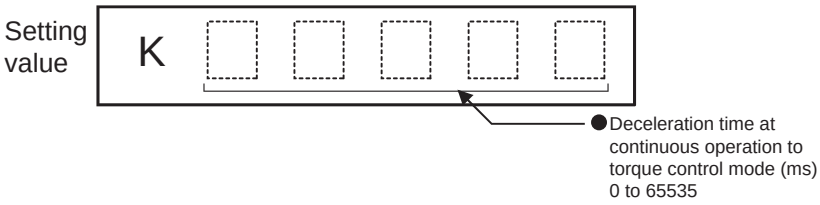
• Set the deceleration time at continuous operation to torque control mode. (Set the time for the speed to decrease from "[Pr.8] Speed limit value" to "0".)

0 to 65535 (ms)

Fetch cycle: At control mode switching

### ■Setting value

• Set with a decimal.




• Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 392 Control data

## [Cd.150] Target torque at continuous operation to torque control mode

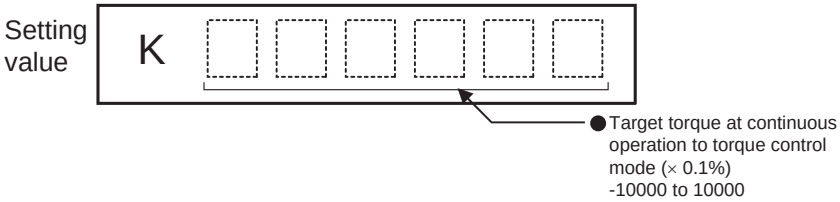
• Set the target torque at continuous operation to torque control mode. Set a ratio against the rated torque in 0.1% unit.

-10000 to 10000 ( × 0.1%)

Fetch cycle: Operation cycle (At continuous operation to torque control mode)

### ■Setting value

• Set with a decimal.




• Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 392 Control data

## [Cd.151] Torque time constant at continuous operation to torque control mode (+*1)

*1 "+" is an abbreviation for "Forward direction".

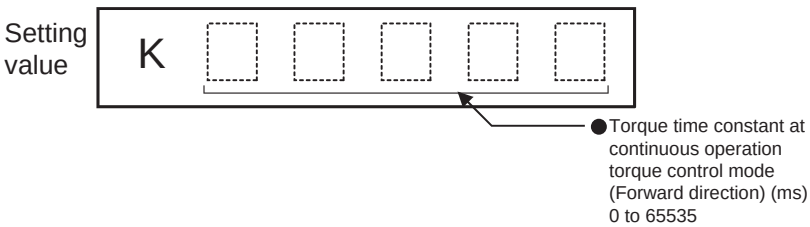
• Set the time constant at driving during continuous operation to torque control mode. (Set the time for the torque to increase from "0" to "[Pr.17] Torque limit setting value".)

0 to 65535 (ms)

Fetch cycle: At control mode switching

### ■Setting value

• Set with a decimal.




• Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 392 Control data

## [Cd.152] Torque time constant at continuous operation to torque control mode (-*1)

*1 "-" is an abbreviation for "Negative direction".

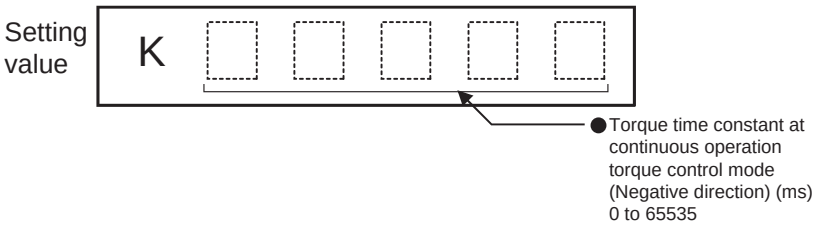
- Set the time constant at regeneration during continuous operation to torque control mode. (Set the time for the torque to decrease from "[Pr.17] Torque limit setting value" to "0".)

0 to 65535 (ms)

Fetch cycle: At control mode switching

### ■Setting value

- Set with a decimal.




- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 392 Control data

## [Cd.153] Control mode auto-shift selection

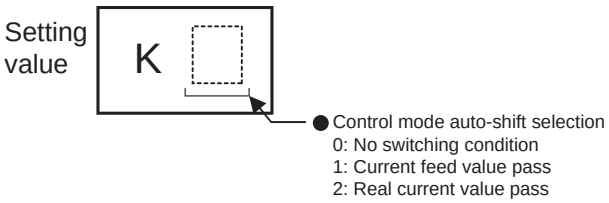
- Set the switching condition when switching to continuous operation to torque control mode.

| Setting value | Details |
|---|---|
| 0: No switching condition | Switching is executed at switching request to continuous operation to torque control mode. |
| 1: Current feed value pass | Switching is executed when "[Md.20] Current feed value" passes the address set in "[Cd.154] Control mode auto-shift parameter" after switching request to continuous operation to torque control mode. |
| 2: Real current value pass | Switching is executed when "[Md.101] Real current value" passes the address set in "[Cd.154] Control mode auto-shift parameter" after switching request to continuous operation to torque control mode. |

Fetch cycle: At control mode switching

### ■Setting value

- Set with a decimal.




- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 392 Control data

## [Cd.154] Control mode auto-shift parameter

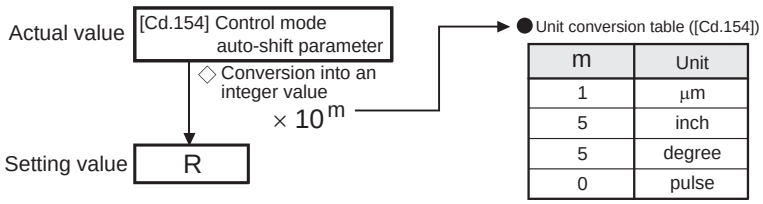
- Set the condition value when setting the control mode switching condition.
- The setting value differs depending on the value set in "[Cd.153] Control mode auto-shift selection". When "1" or "2" is set in "[Cd.153] Control mode auto-shift selection": Set the switching address.
- Set a value within the following range:

| [Pr.1] Unit setting | mm ( × $10^{-1}$ mm) | inch ( × $10^{-5}$ inch) | degree ( × $10^{-5}$ degree) | pulse (pulse) |
|---|---|---|---|---|
| Setting range | -2147483648 to 2147483647 | -2147483648 to 2147483647 | 0 to 35999999 | -2147483648 to 2147483647 |

Fetch cycle: At control mode switching

### ■Setting value

- Set with a decimal.




| m | Unit |
|---|---|
| 1 | μm |
| 5 | inch |
| 5 | degree |
| 0 | pulse |

- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 392 Control data

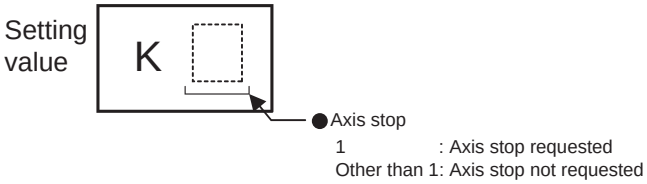
## [Cd.180] Axis stop

- When the axis stop signal turns ON, the home position return control, positioning control, JOG operation, inching operation, manual pulse generator operation, speed-torque control, etc. will stop.
- By turning the axis stop signal ON during positioning operation, the positioning operation will be "stopped".
- Whether to decelerate stop or suddenly stop can be selected with "[Pr.39] Stop group 3 sudden stop selection".
- During interpolation control of the positioning operation, if the axis stop signal of any axis turns ON, all axes in the interpolation control will decelerate and stop.

Fetch cycle: Operation cycle

### ■Setting value

- Set with a decimal.




- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 392 Control data

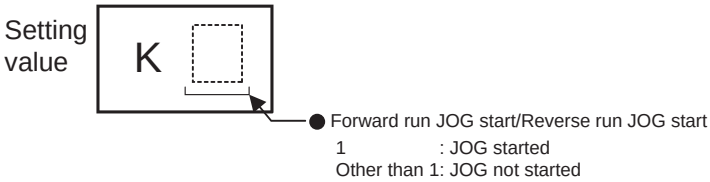
## [Cd.181] Forward run JOG start, [Cd.182] Reverse run JOG start

- When the JOG start signal is ON, JOG operation will be carried out at the "[Cd.17] JOG speed". When the JOG start signal turns OFF, the operation will decelerate and stop.
- When inching movement amount is set, the designated movement amount is output for one operation cycle and then the operation stops.

Fetch cycle: Operation cycle

### ■Setting value

- Set with a decimal.




- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 392 Control data

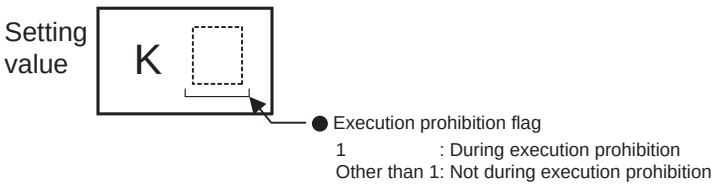
## [Cd.183] Execution prohibition flag

- If the execution prohibition flag is ON when the positioning start signal turns ON, positioning control does not start until the execution prohibition flag turns OFF. Used with the "Pre-reading start function". (☞ Page 266 Pre-reading start function)

Fetch cycle: At start

### ■Setting value

- Set with a decimal.




- Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 392 Control data

# 12.9 Memory Configuration and Data Process

The memory configuration and data transmission of Simple Motion module are explained in this section.
The Simple Motion module is configured of four memories. By understanding the configuration and roles of two memories, the internal data transmission process of Simple Motion module, such as "when the power is turned ON" or "when the PLC READY signal changes from OFF to ON", can be easily understood. This also allows the transmission process to be carried out correctly when saving or changing the data.

## Configuration and roles

The Simple Motion module is configured of the following four memories.
○: Setting and storage area provided, Not possible: Data is lost when power is turned OFF.
—: Setting and storage area not provided, Possible: Data is held even when power is turned OFF.

| Memory configuration | Role | Area configuration | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Parameter area | Monitor data area | Control data area | Positioning data area | | Block start data area | |
| | | | | | (No. 1 to 100) | (No. 101 to 600) | (No. 7000 to 7001) | (No. 7002 to 7004) |
| Buffer memory | Area that can be directly accessed with a program with a CPU module | ○ | ○ | ○ | ○ | — | ○ | — |
| Internal memory | Area that can be set only with the engineering tool | — | — | — | — | ○ | — | ○ |
| | Area that can be set only using buffer memory | — | — | — | — | — | — | — |
| Flash ROM | Area for backing up data required for positioning | ○ | — | — | ○ | ○ | ○ | ○ |
| Internal memory (nonvolatile) | Area for backing up servo parameter or cam data | — | — | — | — | — | — | — |

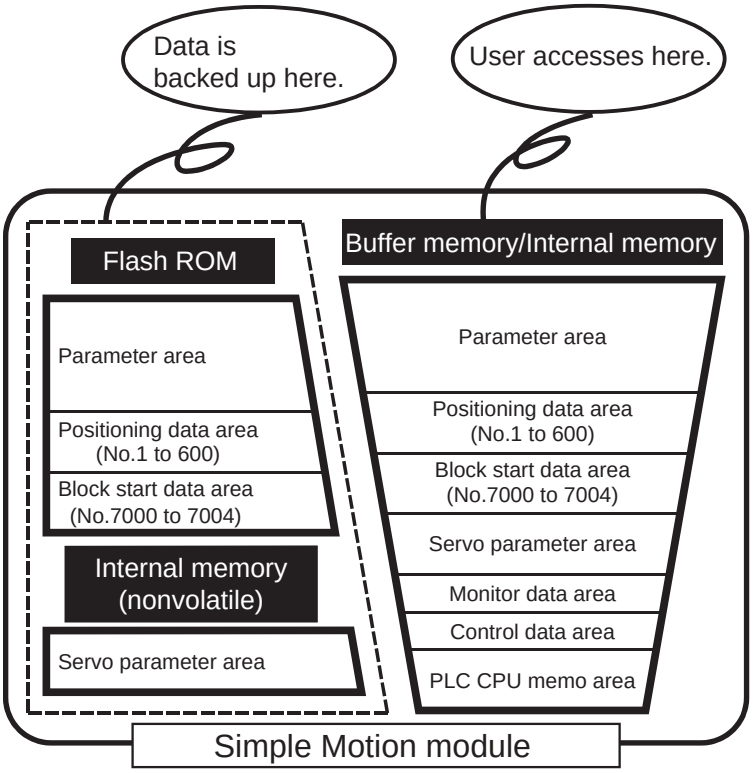
| Memory configuration | Role | Area configuration | | | | Backup |
|---|---|---|---|---|---|---|
| | | PLC CPU memo area | Servo parameter area | Synchronous control area | Cam area | |
| Buffer memory | Area that can be directly accessed with a program with a CPU module | ○ | ○ | ○ | — | Not possible |
| Internal memory | Area that can be set only with the engineering tool | — | — | — | — | Not possible |
| | Area that can be set only using buffer memory | — | — | — | ○ | Not possible |
| Flash ROM | Area for backing up data required for positioning | — | — | ○*1 | — | Possible |
| Internal memory (nonvolatile) | Area for backing up servo parameter or cam data | — | ○ | — | ○ | Possible |

*1 Parameter only

## Details of areas

| Area name | Description |
|---|---|
| Parameter area | Area where parameters, such as positioning parameters and home position return parameters, required for positioning control are set and stored. |
| Monitor data area | Area where the operation status of positioning system is stored. |
| Control data area | Area where data for operating and controlling positioning system is set and stored. |
| Positioning data area (No.1 to 600) | Area where positioning data No.1 to 600 is set and stored. |
| Block start data area (No.7000 to 7004) | Area where information required only when carrying out block No. 7000 to 7004 high-level positioning is set and stored. |
| PLC CPU memo area | Area where condition judgment values required for special positioning, etc., are set and stored. |
| Servo parameter area | Area where parameters, such as servo parameters, required for positioning control on servo amplifier are set and stored. |
| Synchronous control area*1 | Area where parameters and control data required for synchronous control are set and stored. Also, the operation status of synchronous control is stored. |
| Cam area*1 | Area where cam data, etc. are set and stored. There are cam storage area and cam open area. |

*1 Refer to the following for details of synchronous control area and cam area.
MELSEC iQ-R Simple Motion Module User's Manual (Advanced Synchronous Control)



# Buffer memory area configuration

The buffer memory of Simple Motion module is configured of the following types of areas.

n: Axis No. - 1

k: Mark detection setting No. - 1

j: Synchronous encoder axis No. - 1

| Buffer memory area configuration | | | Buffer memory address | Writing possibility |
|---|---|---|---|---|
| Parameter area | Servo network composition parameter area | | 58020 to 58659 | Possible |
| | Common parameter area | | 33, 35, 67, 105, 106, 58000 to 58008 | |
| | Basic parameter area | | 0+150n to 15+150n | |
| | Detailed parameter area | | 17+150n to 69+150n | |
| | Home position return basic parameter area | | 70+150n to 78+150n | |
| | Home position return detailed parameter area | | 79+150n to 91+150n | |
| | Expansion parameter area | | 100+150n to 149+150n | |
| | Mark detection setting parameter area | | 54000+20k to 54019+20k | |
| Monitor data area | System monitor area | | 4000 to 4299<br>31300 to 31549 | Not possible |
| | Axis monitor area | | 2400+100n to 2499+100n | |
| | Servo network composition monitor area | | 58660 to 59328 | |
| | Mark detection monitor data area | | 54960+80k to 55039+80k | |
| Control data area | System control data area | | 5900 to 5999 | Possible |
| | Axis control data area | | 4300+100n to 4399+100n<br>30100+10n to 30109+10n | |
| | Mark detection control data area | | 54640+10k to 54649+10k | |
| Positioning data area (No.1 to 100) | Positioning data area | | 6000+1000n to 6999+1000n<br>71000+1000n, 71001+1000n | Possible |
| Positioning data area (No.101 to 600) | | | Set with the engineering tool. | |
| Block start data area (No.7000) | Block start data area | | 22000+400n to 22049+400n | |
| | | | 22050+400n to 22099+400n | |
| | Condition data area | | 22100+400n to 22199+400n | |
| Block start data area (No.7001) | Block start data area | | 22200+400n to 22249+400n | |
| | | | 22250+400n to 22299+400n | |
| | Condition data area | | 22300+400n to 22399+400n | |
| Block start data area (No.7002) | Block start data area | | Set with the engineering tool. | |
| | Condition data area | | | |
| Block start data area (No.7003) | Block start data area | | | |
| | Condition data area | | | |
| Block start data area (No.7004) | Block start data area | | | |
| | Condition data area | | | |
| PLC CPU memo area | PLC CPU memo area | | 30000 to 30099 | Possible |
| Servo parameter area | PA group | PA01 to PA18 | 28401+100n to 28418+100n | Possible |
| | | PA19 | 64464+70n | |
| | | PA20 to PA32 | 64400+70n to 64412+70n | |
| | PB group | | 28419+100n to 28463+100n | |
| | | | 64413+70n to 64431+70n | |
| | PC group | | 28464+100n to 28495+100n | |
| | | | 64432+70n to 64463+70n | |
| | PD group | | 65520+340n to 65567+340n | |
| | PE group | | 65568+340n to 65631+340n | |
| | PS group | | 65712+340n to 65743+340n | |
| | PF group | | 65632+340n to 65679+340n | |
| | Po group | | 65680+340n to 65711+340n | |
| | PL group | | 65744+340n to 65791+340n | |

| Buffer memory area configuration | | Buffer memory address | Writing possibility |
|---|---|---|---|
| Synchronous control area | Servo input axis parameter | 32800+10n to 32805+10n | Possible |
| | Servo input axis monitor data | 33120+10n to 33127+10n | Not possible |
| | Synchronous encoder axis parameter | 34720+20j to 34735+20j | Possible |
| | Synchronous encoder axis control data | 35040+10j to 35047+10j | Possible |
| | Synchronous encoder axis monitor data | 35200+20j to 35212+20j | Not possible |
| | Synchronous control system control data | 36320, 36322 | Possible |
| | Synchronous parameter | 36400+200n to 36513+200n | Possible |
| | Synchronous control monitor data | 42800+40n to 42835+40n | Not possible |
| | Control data for synchronous control | 44080+20n to 44090+20n | Possible |
| | Cam operation control data | 45000 to 53791 | Possible |
| | Cam operation monitor data | 53800 to 53801 | Not possible |

*1 Use of skipped address Nos. is prohibited. If used, the system may not operate correctly.

**Point**

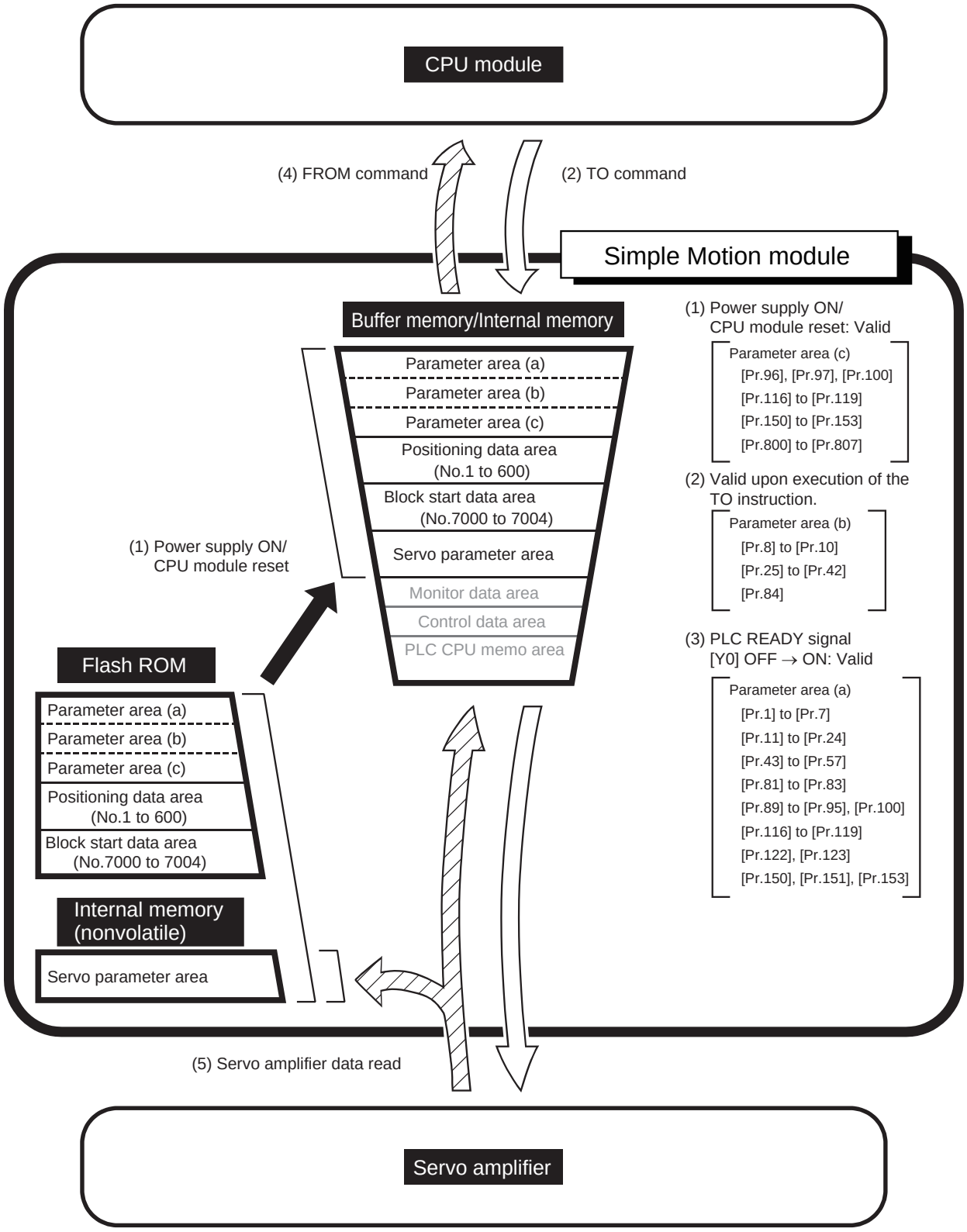
When the parameter of the servo amplifier side is changed by the following method, the Simple Motion module reads parameters automatically, and the data is transmitted to the servo parameter area in the buffer memory and internal memory (nonvolatile).

- When changing the servo parameters by the auto tuning.
- When the servo parameter is changing after the MR Configurator2 is connected directly with the servo amplifier.

# Data transmission process

The data is transmitted between the memories of Simple Motion module with steps (1) to (10) shown below.

*1 The data transmission patterns correspond to the numbers (1) to (10) in the following drawings.



## (1) Transmitting data when power is turned ON or CPU module is reset

When the power is turned ON or the CPU module is reset, the "parameters area (c)[*1]", "positioning data", "block start data" and "servo parameter" stored (backed up) in the flash ROM/internal memory (nonvolatile) are transmitted to the buffer memory and internal memory.

*1 Parameter area (c):
Parameters validated with power supply ON/CPU module reset.
([Pr.96], [Pr.97], [Pr.100], [Pr.116] to [Pr.119], [Pr.150] to [Pr.153], [Pr.800] to [Pr.807])

## (2) Transmitting data with TO command from CPU module

The parameters or data is written from the CPU module to the buffer memory using the TO command[*1].
At this time, when the "parameter area (b)[*2]", "positioning data", "block start data", "control data" and "PLC CPU memo area" are written into the buffer memory with the TO command, it is simultaneously valid.

*1 "Positioning data (No.101 to 600)" and "Block start data (No.7002 to 7004)" can be set with only the engineering tool.
*2 Parameter area (b):
Parameters validated with next each positioning control is started.
([Pr.8] to [Pr.10], [Pr.25] to [Pr.42], [Pr.84])

**Point**

When a value other than "0" has been set to the servo network composition parameter "[Pr.100] Connected device" inside the internal memory (nonvolatile), the power is turned ON or CPU module is reset to transmit the servo parameter inside the internal memory (nonvolatile) to the servo amplifier (servo amplifier LED indicates "b□"). After that, the TO instruction writes the servo parameter from the CPU module to the buffer memory so that the servo parameter in the buffer memory is not transmitted to the servo amplifier even if the PLC READY signal [Y0] is turned OFF then ON. Change the servo parameter with the above method, after setting the servo network composition parameter "[Pr.100] Connected device" inside the internal memory (nonvolatile), to "0".

## (3) Validate parameters when PLC READY signal [Y0] changes from OFF to ON

When the PLC READY signal [Y0] changes from OFF to ON, the data stored in the buffer memory's "parameter area (a)[*1]" is validated.

*1 Parameter area (a):
Parameters validated when PLC READY signal [Y0] changes from OFF to ON.
([Pr.1] to [Pr.7], [Pr.11] to [Pr.24], [Pr.43] to [Pr.57], [Pr.81] to [Pr.83], [Pr.89] to [Pr.95], [Pr.100], [Pr.116] to [Pr.119], [Pr.122], [Pr.123], [Pr.150], [Pr.151], [Pr.153])

**Point**

The setting values of the parameters that correspond to parameter area (b) are valid when written into the buffer memory with the TO command. However, the setting values of the parameters that correspond to parameter area (a) are not validated until the PLC READY signal [Y0] changes from OFF to ON.

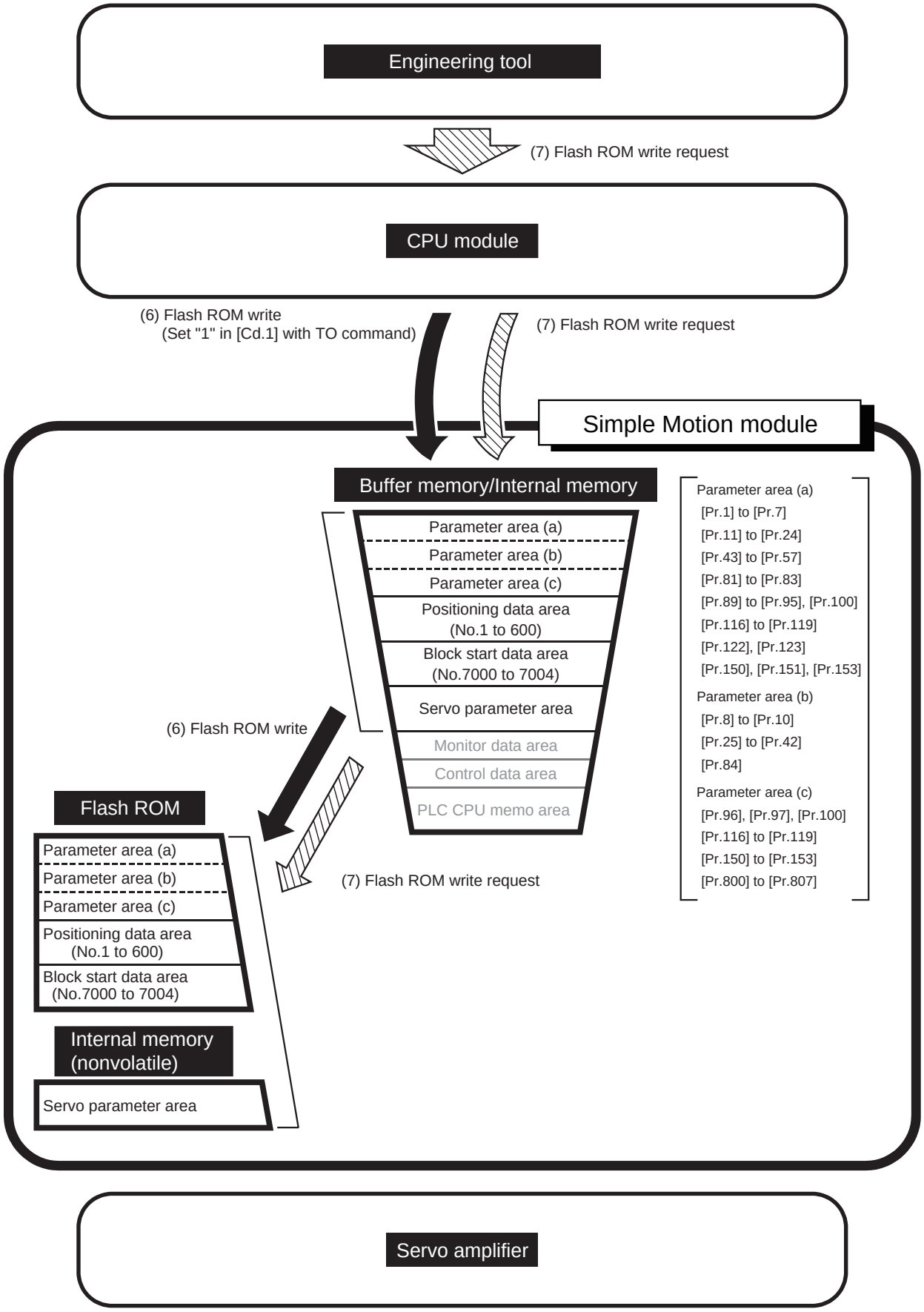
## (4) Accessing with FROM command from CPU module

The data is read from the buffer memory to the CPU module using the FROM command[*1].

*1 "Positioning data (No.101 to 600)" and "Block start data (No.7002 to 7004)" can be read with only the engineering tool.

## (5) Reading the servo parameter from the servo amplifier

When the parameter of the servo amplifier is changed, the servo parameter is read automatically from the servo amplifier to the buffer memory/internal memory and internal memory (nonvolatile).


Engineering tool
(7) Flash ROM write request
CPU module
(6) Flash ROM write
(Set "1" in [Cd.1] with TO command)
(7) Flash ROM write request
Simple Motion module
Buffer memory/Internal memory
Parameter area (a)
Parameter area (b)
Parameter area (c)
Positioning data area
(No.1 to 600)
Block start data area
(No.7000 to 7004)
Servo parameter area
Monitor data area
Control data area
PLC CPU memo area
Parameter area (a)
[Pr.1] to [Pr.7]
[Pr.11] to [Pr.24]
[Pr.43] to [Pr.57]
[Pr.81] to [Pr.83]
[Pr.89] to [Pr.95], [Pr.100]
[Pr.116] to [Pr.119]
[Pr.122], [Pr.123]
[Pr.150], [Pr.151], [Pr.153]
Parameter area (b)
[Pr.8] to [Pr.10]
[Pr.25] to [Pr.42]
[Pr.84]
Parameter area (c)
[Pr.96], [Pr.97], [Pr.100]
[Pr.116] to [Pr.119]
[Pr.150] to [Pr.153]
[Pr.800] to [Pr.807]
(6) Flash ROM write
(7) Flash ROM write request
Flash ROM
Parameter area (a)
Parameter area (b)
Parameter area (c)
Positioning data area
(No.1 to 600)
Block start data area
(No.7000 to 7004)
Internal memory
(nonvolatile)
Servo parameter area
Servo amplifier

## (6) Writing the flash ROM by a CPU module request

The following transmission process is carried out by setting "1" in "[Cd.1] Flash ROM write request".

- The "parameters", "positioning data (No. 1 to 600)", "block start data (No. 7000 to 7004)" and "servo parameter" in the buffer memory/internal memory area are transmitted to the flash ROM/internal memory (nonvolatile).

## (7) Writing the flash ROM by a request from the engineering tool

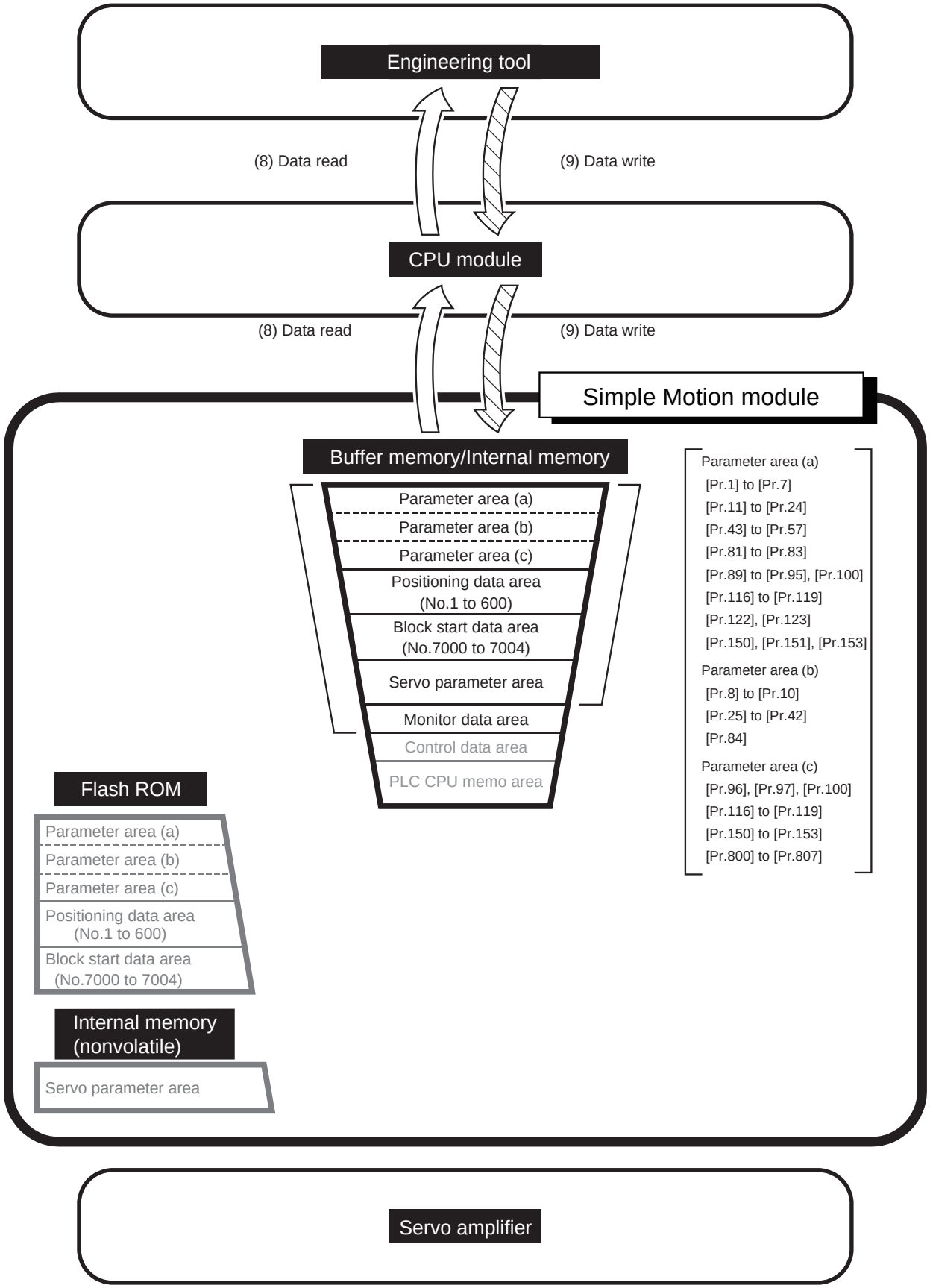
The following transmission processes are carried out with the [flash ROM write request] from the engineering tool.

- The "parameters", "positioning data (No. 1 to 600)", "block start data (No. 7000 to 7004)" and "servo parameter" in the buffer memory/internal memory area are transmitted to the flash ROM/internal memory (nonvolatile).

*1 This transmission process is the same as (6) above.

**Point**

- Do not turn the power OFF or reset the CPU module while writing to the flash ROM. If the power is turned OFF or the CPU module is reset to forcibly end the process, the data backed up in the flash ROM/internal memory (nonvolatile) will be lost.
- Do not write the data to the buffer memory/internal memory before writing to the flash ROM is completed.
- The number of writes to the flash ROM with the program is 25 max. while the power is turned ON. Writing to the flash ROM beyond 25 times will cause the error "Flash ROM write number error" (error code: 1080H). Refer to ☞ Page 591 List of Error Codes for details.
- Monitoring is the number of writes to the flash ROM after power supply ON by the "[Md.19] Number of write accesses to flash ROM".


Engineering tool
(8) Data read
(9) Data write
CPU module
(8) Data read
(9) Data write
Simple Motion module
Buffer memory/Internal memory
Parameter area (a)
Parameter area (b)
Parameter area (c)
Positioning data area (No.1 to 600)
Block start data area (No.7000 to 7004)
Servo parameter area
Monitor data area
Control data area
PLC CPU memo area
Parameter area (a)
[Pr.1] to [Pr.7]
[Pr.11] to [Pr.24]
[Pr.43] to [Pr.57]
[Pr.81] to [Pr.83]
[Pr.89] to [Pr.95], [Pr.100]
[Pr.116] to [Pr.119]
[Pr.122], [Pr.123]
[Pr.150], [Pr.151], [Pr.153]
Parameter area (b)
[Pr.8] to [Pr.10]
[Pr.25] to [Pr.42]
[Pr.84]
Parameter area (c)
[Pr.96], [Pr.97], [Pr.100]
[Pr.116] to [Pr.119]
[Pr.150] to [Pr.153]
[Pr.800] to [Pr.807]
Flash ROM
Parameter area (a)
Parameter area (b)
Parameter area (c)
Positioning data area (No.1 to 600)
Block start data area (No.7000 to 7004)
Internal memory (nonvolatile)
Servo parameter area
Servo amplifier

## (8) Reading data from buffer memory/internal memory to the engineering tool

The following transmission processes are carried out with the [Read from module (Read from RD77MS)] from the engineering tool.

- The "parameters", "positioning data (No. 1 to 600)", "block start data (No. 7000 to 7004)" and "servo parameter" in the buffer memory/internal memory area are transmitted to the engineering tool via the CPU module.

The following transmission processes are carried out with the [monitor] from the engineering tool.

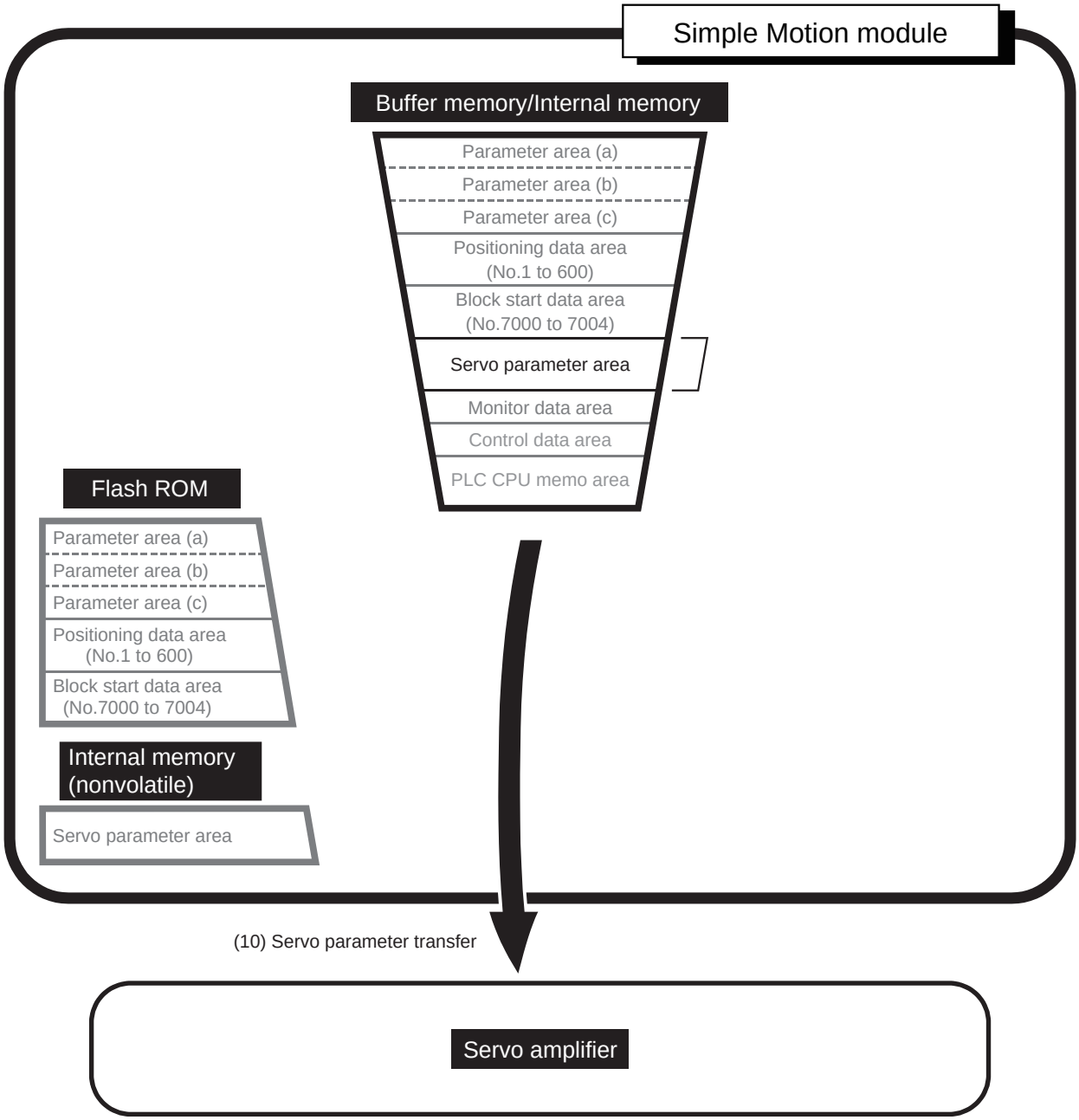
- The "monitor data" in the buffer memory area is transmitted to the engineering tool via the CPU module.

## (9) Writing data from the engineering tool to buffer memory/internal memory

The following transmission processes are carried out with the [Write to module (Write to RD77MS)] from the engineering tool.

- The "parameters", "positioning data (No. 1 to 600)", "block start data (No. 7000 to 7004)" and "servo parameter" in the engineering tool are transmitted to the buffer memory/internal memory via the CPU module.

At this time, when [Flash ROM automatic write] is set with the engineering tool, the transmission processes indicated with "(7) Flash ROM write" are carried out.




## (10) Transmitting servo parameter

The servo parameter in the buffer memory/internal memory area is transmitted to the servo amplifier by the following timing.

- The servo parameter is transmitted to the servo amplifier when communications with servo amplifier start. The "servo parameter" in the buffer memory area is transmitted to the servo amplifier.

**Point**

When the PLC READY signal [Y0] is turned ON, the warning "SSCNET communication error" (warning code: 093EH) occurs, "Rotation direction selection/travel direction selection (PA14)" is changed by the program or the engineering tool after the servo parameter is transmitted to servo amplifier (LED of the servo amplifier is indicated b☐, C☐, or d☐). When "Rotation direction selection/travel direction selection (PA14)" is changed, transmit the servo parameter to servo amplifier.

### ■About the communication start with servo amplifier

Communication with servo amplifier is valid when following conditions are realized together.

- The power of Simple Motion module and servo amplifier is turned ON.
- The servo network composition parameter "[Pr.100] Connected device" in the buffer memory of the Simple Motion module is set with a value other than "0".

When the power is turned ON or the CPU module is reset, the data stored in the flash ROM/internal memory (nonvolatile) is transmitted to the buffer memory/internal memory.

Therefore, when the servo network composition parameter "[Pr.100] Connected device" stored in the internal memory (nonvolatile) is set with a value other than "0" and the module is started up in order of the servo amplifier and the Simple Motion module (even before the RUN LED of the CPU module is turned ON), the communication with the servo amplifier is started and the servo parameter stored in the internal memory (nonvolatile) is transmitted to the servo amplifier.



### ■How to transfer the servo parameter setup from the program/engineering tool to the servo amplifier

The servo series of servo network composition parameter "[Pr.100] Connected device" inside the internal memory (nonvolatile) set to "0". (Initial value: "0")

The setting value of the parameters that correspond to the servo network composition parameter "[Pr.100] Connected device" inside the internal memory (nonvolatile) becomes valid when the power is turned ON or the CPU module is reset, after the communication with servo amplifier is not started.

However, the PLC READY signal [Y0] is changed from OFF to ON after setting the servo network composition parameters ("[Pr.100] Connected device": except for 0) with the program/engineering tool the communication with servo amplifier starts.

### ■How to transfer the servo parameter which wrote it in the internal memory (nonvolatile) to servo amplifier

Flash ROM writing carried out after the servo parameter is set up in the buffer memory/internal memory.

After that, when the power is turned ON or the CPU module is reset, the servo parameters stored in the internal memory (nonvolatile) is transmitted to the buffer memory/internal memory.

When the servo parameter is written in the internal memory (nonvolatile), it is unnecessary to use a setup from the program/engineering tool.

## ■Servo parameter of the buffer memory/internal memory

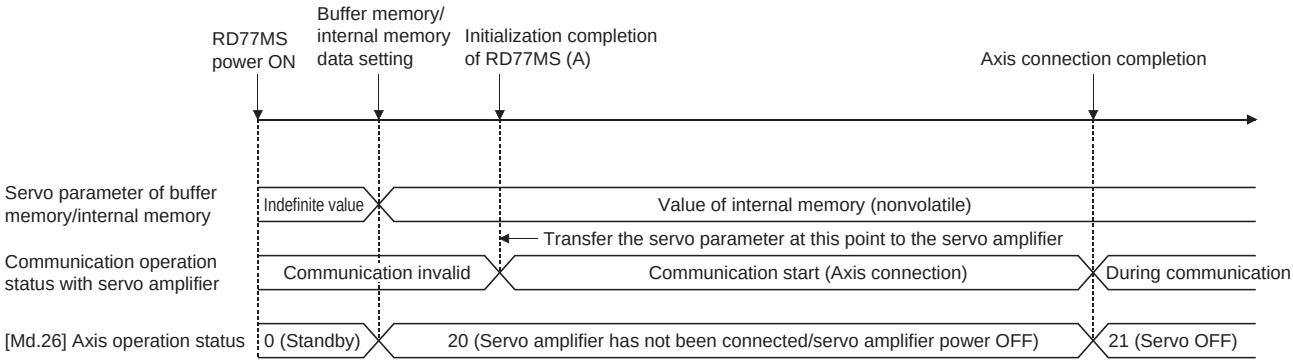
The followings show details about the operation timing and details at transmitting the servo parameter of the buffer memory/internal memory.

**Point**

- When the servo parameter is written in the internal memory (nonvolatile), it is unnecessary to use a setup from the program/engineering tool.
- Axis connection time varies depending on the number of axes and the servo amplifier's power supply ON timing. And, time when "20: Servo amplifier has not been connected/servo amplifier power OFF" is set in "[Md.26] Axis operation status" is also varies.

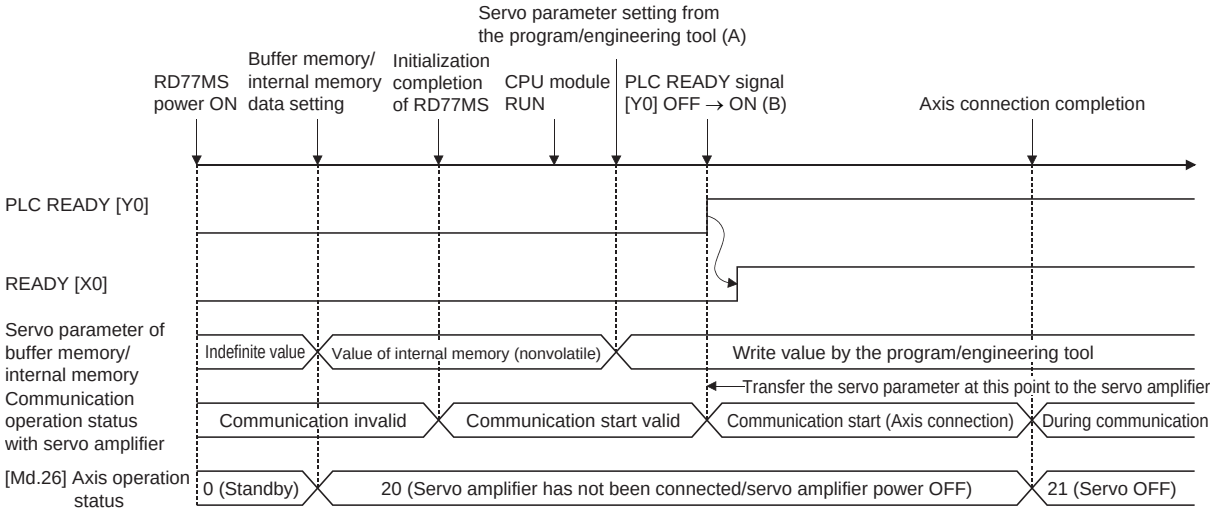
- When the servo amplifier's power supply is turned ON before the system's power supply ON and the servo network composition parameter "[Pr.100] Connected device" ≠ "0" is stored in the internal memory (nonvolatile)

| | |
|---|---|
| Communication start timing with the servo amplifier | Initialization completion ((A) in the following figure) |
| Servo parameter to be transferred | The data stored (backed up) in the internal memory (nonvolatile). |


RD77MS power ON
Buffer memory/ internal memory data setting
Initialization completion of RD77MS (A)
Axis connection completion
Servo parameter of buffer memory/internal memory
Indefinite value
Value of internal memory (nonvolatile)
Transfer the servo parameter at this point to the servo amplifier
Communication operation status with servo amplifier
Communication invalid
Communication start (Axis connection)
During communication
[Md.26] Axis operation status
0 (Standby)
20 (Servo amplifier has not been connected/servo amplifier power OFF)
21 (Servo OFF)

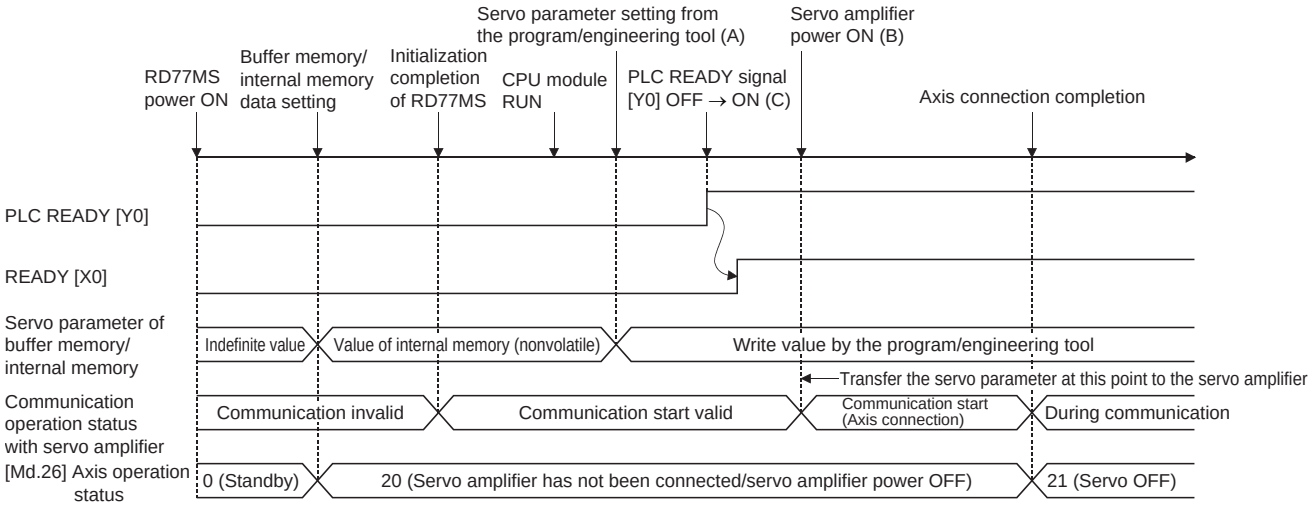
- When the servo amplifier's power supply is turned ON before the system's power supply ON and the servo network composition parameter "[Pr.100] Connected device" = "0" is stored in the internal memory (nonvolatile)

| | |
|---|---|
| Communication start timing with the servo amplifier | The PLC READY signal [Y0] is turned ON from OFF. ((B) in the following figure) |
| Servo parameter to be transferred | The data written from the program/engineering tool before the PLC READY signal [Y0] ON. ((A) in the following figure) |


Servo parameter setting from the program/engineering tool (A)
RD77MS power ON
Buffer memory/ internal memory data setting
Initialization completion of RD77MS
CPU module RUN
PLC READY signal [Y0] OFF → ON (B)
Axis connection completion
PLC READY [Y0]
READY [X0]
Servo parameter of buffer memory/ internal memory
Indefinite value
Value of internal memory (nonvolatile)
Write value by the program/engineering tool
Transfer the servo parameter at this point to the servo amplifier
Communication operation status with servo amplifier
Communication invalid
Communication start valid
Communication start (Axis connection)
During communication
[Md.26] Axis operation status
0 (Standby)
20 (Servo amplifier has not been connected/servo amplifier power OFF)
21 (Servo OFF)

- When the servo amplifier's power supply is turned ON after the PLC READY signal [Y0] is turned OFF to ON ((C) in the following figure)

| | |
|---|---|
| Communication start timing with the servo amplifier | When the servo amplifier had started ((B) in the following figure) |
| Servo parameter to be transferred | The data written from the program/engineering tool before the PLC READY signal [Y0] ON. ((A) in the following figure) |


Servo parameter setting from the program/engineering tool (A)
Servo amplifier power ON (B)
RD77MS power ON
Buffer memory/ internal memory data setting
Initialization completion of RD77MS
CPU module RUN
PLC READY signal [Y0] OFF → ON (C)
Axis connection completion
PLC READY [Y0]
READY [X0]
Servo parameter of buffer memory/ internal memory
Indefinite value
Value of internal memory (nonvolatile)
Write value by the program/engineering tool
Transfer the servo parameter at this point to the servo amplifier
Communication operation status with servo amplifier
Communication invalid
Communication start valid
Communication start (Axis connection)
During communication
[Md.26] Axis operation status
0 (Standby)
20 (Servo amplifier has not been connected/servo amplifier power OFF)
21 (Servo OFF)

## ■How to change individually the servo parameter after transfer of servo parameter

The servo parameters can be individually changed from Simple Motion module with the following axis control data.

n: Axis No. - 1

| Setting item | | Setting details | Buffer memory address |
|---|---|---|---|
| [Cd.130] | Servo parameter write request | Set the write request of servo parameter.<br>Set "1" or "2" after setting "[Cd.131] Parameter No. (Setting for servo parameters to be changed)" and "[Cd.132] Change data".<br>1: 1 word write request<br>2: 2 words write request<br>Other than 1 and 2: Not request | 4354+100n |
| [Cd.131] | Parameter No. (Setting for servo parameters to be changed) | Set the servo parameter to be changed. | 4355+100n |
| [Cd.132] | Change data | Set the change value of servo parameter set in "[Cd.131] Parameter No. (Setting for servo parameters to be changed)". | 4356+100n<br>4357+100n |

**Point**

- Both of the servo parameter area (internal memory (nonvolatile) and buffer memory/internal memory) of Simple Motion module and the parameter of servo amplifier are changed.
- When the servo parameters that become valid by turning ON the servo amplifier's power supply are changed, be sure to turn ON twice the servo amplifier's power supply after change. (The servo amplifier's RAM data are changed by parameter setting, but the servo amplifier's EEPROM data are not changed. The EEPROM data before the change are overwritten to RAM by the servo amplifier's power supply ON again, and then the servo amplifier starts. After that, the changed data are written to the servo amplifier's EEPROM in an initial communication with Simple Motion module. Therefore, the changed data are overwritten to the RAM data by turning the servo amplifier's power supply ON again.)

# 13 PROGRAMMING

This chapter describes the programs required to carry out positioning control with the Simple Motion module.
The program required for control is created allowing for the "start conditions", "start time chart", "device settings" and general control configuration. (The parameters, positioning data, block start data and condition data, etc., must be set in the Simple Motion module according to the control to be executed, and a setting program for the control data or a start program for the various controls must be created.)

## 13.1 Precautions for Creating Program

The common precautions to be taken when writing data from the CPU module to the buffer memory of the Simple Motion module are described below.

### Reading/writing the data

Setting the data explained in this chapter (various parameters, positioning data, block start data) should be set using an engineering tool. When set with the program, many programs and devices must be used. This will not only complicate the program, but will also increase the scan time. When rewriting the positioning data during continuous path control or continuous positioning control, rewrite the data four positioning data items before the actual execution. If the positioning data is not rewritten before the positioning data four items earlier is executed, the process will be carried out as if the data was not rewritten.

### Restrictions to speed change execution interval

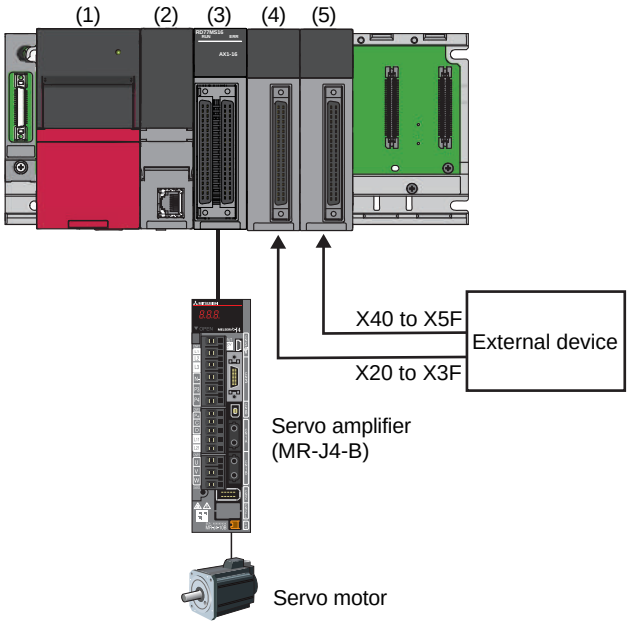
Be sure there is an interval between the speed changes of 10 ms or more when carrying out consecutive speed changes by the speed change function or override function with the Simple Motion module.

### Process during overrun

Overrun is prevented by the setting of the upper and lower stroke limits with the detailed parameter 1. However, this applies only when the Simple Motion module is operating correctly. It is recommended to create an external circuit including a boundary limit switch to ensure the whole system safety as follows: the external circuit that turns OFF the main circuit power of the servo amplifier when the boundary limit switch operates.

## System configuration

The following figure shows the system configuration used for the program examples.




(1) R61P
(2) R16CPU
(3) RD77MS16 (X0 to X1F/Y0 to Y1F)
(4) RX40C7 (X20 to X3F)
(5) RX40C7 (X40 to X5F)

# 13.2 List of Labels Used

In the program examples, the labels to be used are assigned as follows.

## Module label

| Classification | Label name | Description |
|---|---|---|
| Start I/O No. | RD77_1.uIO | Start I/O No. |
| Input signal | RD77_1.bAllAxisServoOn | RD77 All axis servo ON |
| | RD77_1.bReady | RD77 READY |
| | RD77_1.bSynchronizationFlag | RD77 Synchronization flag |
| | RD77_1.bSynchronizationFlag_D | |
| | RD77_1.bnBusy[0] | Axis 1 BUSY signal |
| | RD77_1.bnBusy_D[0] | |
| Output signal | RD77_1.bPLC_Ready | PLC READY signal |
| | RD77_1.bnPositioningStart[0] | Axis 1 Positioning start signal |
| Parameter | RD77_1.stnAxPrm_D[0].dHomePosition_D | Axis 1 Home position address |
| | RD77_1.stnAxPrm_D[0].dSoftwareStrokeLowerLimit_D | Axis 1 Software stroke limit lower limit value |
| | RD77_1.stnAxPrm_D[0].dSoftwareStrokeUpperLimit_D | Axis 1 Software stroke limit upper limit value |
| | RD77_1.stnAxPrm_D[0].uExternalCommandFunctionMode_D | Axis 1 External command function selection |
| | RD77_1.stnAxPrm_D[0].uExternalCommandSignalMode_D | Axis 1 External command signal selection |
| | RD77_1.stnAxPrm_D[0].uHomingDirection_D | Axis 1 Home position return direction |
| | RD77_1.stnAxPrm_D[0].uHomingMethod_D | Axis 1 Home position return method |
| | RD77_1.stnAxPrm_D[0].uHomingRetry_D | Axis 1 Home position return retry |
| | RD77_1.stnAxPrm_D[0].uUnitMagnification_D | Axis 1 Unit magnification (AM) |
| | RD77_1.stnAxPrm_D[0].uUnit_D | Axis 1 Unit setting |
| | RD77_1.stnAxPrm_D[0].uVP_Mode_D | Axis 1 Speed-position function selection |
| | RD77_1.stnAxPrm_D[0].uV_CommandPosition_D | Axis 1 Current feed value during speed control |
| | RD77_1.stnAxPrm_D[0].udCreepSpeed_D | Axis 1 Creep speed |
| | RD77_1.stnAxPrm_D[0].udHomingSpeed_D | Axis 1 Home position return speed |
| | RD77_1.stnAxPrm_D[0].udMovementAmountPerRotation_D | Axis 1 Movement amount per rotation (AL) |
| | RD77_1.stnAxPrm_D[0].udPulsesPerRotation_D | Axis 1 Number of pulses per rotation (AP) |
| Axis monitor data | RD77_1.stnAxMntr[0].uM_Code | Axis 1 Valid M code |
| | RD77_1.stnAxMntr[0].uStatus.3 | Axis 1 Home position return request flag |
| | RD77_1.stnAxMntr[0].uStatus.9 | Axis 1 Warning detection |
| | RD77_1.stnAxMntr[0].uStatus.C | Axis 1 M code ON |
| | RD77_1.stnAxMntr[0].uStatus.D | Axis 1 Error detection |
| | RD77_1.stnAxMntr_D[0].uStatus_D.D | |
| | RD77_1.stnAxMntr[0].uStatus.E | Axis 1 Start complete |
| | RD77_1.stnAxMntr_D[0].uStatus_D.E | |
| | RD77_1.stnAxMntr_D[0].uStatus_D.F | Axis 1 Positioning complete |
| | RD77_1.stnAxMntr_D[0].dCommandPosition_D | Axis 1 Current feed value |
| System monitor data | RD77_1.stSysMntr1_D.wSSCNET_ControlStatus_D | SSCNET control status |
| Axis control data 1 | RD77_1.stnAxCtrl1_D[0].dNewPosition_D | Axis 1 New current value |
| | RD77_1.stnAxCtrl1_D[0].uClearHomingRequestFlag_D | Axis 1 Home position return request flag OFF request |
| | RD77_1.stnAxCtrl1_D[0].uClear_M_Code_D | Axis 1 M code OFF request |
| | RD77_1.stnAxCtrl1_D[0].uEnablePV_Switching_D | Axis 1 Position-speed switching enable flag |
| | RD77_1.stnAxCtrl1_D[0].uExternalCommandValid_D | Axis 1 External command valid |
| | RD77_1.stnAxCtrl1_D[0].uForwardNewTorque_D | Axis 1 New torque value/forward new torque value |
| | RD77_1.stnAxCtrl1_D[0].uInterruptOperation_D | Axis 1 Interrupt request during continuous operation |
| | RD77_1.stnAxCtrl1_D[0].uOverride_D | Axis 1 Positioning operation speed override |
| | RD77_1.stnAxCtrl1_D[0].uPositioningStartNo_D | Axis 1 Positioning start No. |
| | RD77_1.stnAxCtrl1_D[0].uPositioningStartingPointNo_D | Axis 1 Positioning starting point No. |
| | RD77_1.stnAxCtrl1_D[0].uSkip_D | Axis 1 Skip command |

| Classification | Label name | Description |
|---|---|---|
| Axis control data 1 | RD77_1.stnAxCtrl1_D[0].uStepMode_D | Axis 1 Step mode |
| | RD77_1.stnAxCtrl1_D[0].uStepStartInformation_D | Axis 1 Step start information |
| | RD77_1.stnAxCtrl1_D[0].uStepValid_D | Axis 1 Step valid flag |
| | RD77_1.stnAxCtrl1_D[0].uTeachingDataSelection_D | Axis 1 Teaching data selection |
| | RD77_1.stnAxCtrl1_D[0].uTeachingPositioningDataNo_D | Axis 1 Teaching positioning data No. |
| | RD77_1.stnAxCtrl1_D[0].udNewSpeed_D | Axis 1 New speed value |
| | RD77_1.stnAxCtrl1_D[0].udPV_NewSpeed_D | Axis 1 Position-speed switching control speed change register |
| | RD77_1.stnAxCtrl1_D[0].udVP_NewMovementAmount_D | Axis 1 Speed-position switching control movement amount change register |
| System control data | RD77_1.stSysCtrl_D.wSSCNET_ControlCommand_D | SSCNET control command |
| Axis control data 2 | RD77_1.stnAxCtrl2_D[0].uProhibitPositioning_D | Axis 1 Execution prohibition flag |
| | RD77_1.stnAxCtrl2_D[0].uProhibitPositioning_D.0 | |
| | RD77_1.stnAxCtrl2_D[0].uStopAxis_D | Axis 1 Axis stop |
| | RD77_1.stnAxCtrl2_D[0].uStopAxis_D.0 | |
| Servo network composition parameter | RD77_1.stnSvNetPrm_D[0].udConnectedDevice_D | Axis 1 Connected device |

## Global label

The following describes the global labels used in the program examples. Set the global labels as follows.

- Global label that the assignment device is to be set

| | Label Name | Data Type | | Class | Assign (Device/Label) |
|---|---|---|---|---|---|
| 1 | bOutpuAbsReq | Bit | ... | VAR_GLOBAL | Y62 |
| 2 | bOutpuAbsTrMode | Bit | ... | VAR_GLOBAL | Y61 |
| 3 | bOutpuServoON | Bit | ... | VAR_GLOBAL | Y60 |
| 4 | bInputFastStartReq | Bit | ... | VAR_GLOBAL | X52 |
| 5 | bAllAxisServoOnReq | Bit | ... | VAR_GLOBAL | X4F |
| 6 | bInputbInputSpeedPositionSwitchingAbsSetReq | Bit | ... | VAR_GLOBAL | X4D |
| 7 | bInputTrDataComp | Bit | ... | VAR_GLOBAL | X49 |
| 8 | bInputAbsBit1 | Bit | ... | VAR_GLOBAL | X48 |
| 9 | bInputAbsBit0 | Bit | ... | VAR_GLOBAL | X47 |
| 10 | bInputStepStartInformationReq | Bit | ... | VAR_GLOBAL | X46 |
| 11 | bInputTargetPositionChangeReq | Bit | ... | VAR_GLOBAL | X45 |
| 12 | bInputSetInchingMovementAmountReq | Bit | ... | VAR_GLOBAL | X44 |
| 13 | bInputChangePositionSpeedSwitchingSpeedReq | Bit | ... | VAR_GLOBAL | X43 |
| 14 | bInputPositionSpeedSwitchingDisableReq | Bit | ... | VAR_GLOBAL | X42 |
| 15 | bInputPositionSpeedSwitchingEnableReq | Bit | ... | VAR_GLOBAL | X41 |
| 16 | bInputPositionSpeedSwitchingReq | Bit | ... | VAR_GLOBAL | X40 |
| 17 | bInputStopReq | Bit | ... | VAR_GLOBAL | X3F |
| 18 | bInputErrResetReq | Bit | ... | VAR_GLOBAL | X3E |
| 19 | bInputWriteFlashReq | Bit | ... | VAR_GLOBAL | X3D |
| 20 | bInputInitializeParameterReq | Bit | ... | VAR_GLOBAL | X3C |
| 21 | bInputRestartReq | Bit | ... | VAR_GLOBAL | X3B |
| 22 | bInputStopContinuousOperationReq | Bit | ... | VAR_GLOBAL | X3A |
| 23 | bInputTeachingReq | Bit | ... | VAR_GLOBAL | X39 |
| 24 | bInputSkipReq | Bit | ... | VAR_GLOBAL | X38 |
| 25 | bInputStepOperationReq | Bit | ... | VAR_GLOBAL | X37 |
| 26 | bInputChangeTorqueReq | Bit | ... | VAR_GLOBAL | X36 |
| 27 | bInputChangeAccDecTimeDisable | Bit | ... | VAR_GLOBAL | X35 |
| 28 | bInputChangeAccDecTimeReq | Bit | ... | VAR_GLOBAL | X34 |
| 29 | bInputOverrideReq | Bit | ... | VAR_GLOBAL | X33 |
| 30 | bInputChangeSpeedReq | Bit | ... | VAR_GLOBAL | X32 |
| 31 | bInputStartMPGReq | Bit | ... | VAR_GLOBAL | X30 |
| 32 | bInputReverseJogStartReq | Bit | ... | VAR_GLOBAL | X2F |
| 33 | bInputForwardJogStartReq | Bit | ... | VAR_GLOBAL | X2E |
| 34 | bInputSetJogSpeedReq | Bit | ... | VAR_GLOBAL | X2D |
| 35 | bInputMcodeOffReq | Bit | ... | VAR_GLOBAL | X2C |
| 36 | bInputStartPositioningReq | Bit | ... | VAR_GLOBAL | X2B |
| 37 | bInputStartAdvancedPositioningReq | Bit | ... | VAR_GLOBAL | X2A |
| 38 | bInputChangeSpeedPositionSwitchingMovementAmount | Bit | ... | VAR_GLOBAL | X29 |
| 39 | bInputSpeedPositionSwitchingDisableReq | Bit | ... | VAR_GLOBAL | X28 |
| 40 | bInputSpeedPositionSwitchingEnableReq | Bit | ... | VAR_GLOBAL | X27 |
| 41 | bInputSpeedPositionSwitchingReq | Bit | ... | VAR_GLOBAL | X26 |
| 42 | bInputSetStartPositioningNoReq | Bit | ... | VAR_GLOBAL | X25 |
| 43 | bInputFastOPRStartReq | Bit | ... | VAR_GLOBAL | X24 |
| 44 | bInputOPRStartReq | Bit | ... | VAR_GLOBAL | X23 |
| 45 | bInputExternalCommandInvalidReq | Bit | ... | VAR_GLOBAL | X22 |
| 46 | bInputExternalCommandValidReq | Bit | ... | VAR_GLOBAL | X21 |
| 47 | bInputOPRReqFlagOffReq | Bit | ... | VAR_GLOBAL | X20 |

- Global label that the assignment device is not to be set (The unused internal relay and data device are automatically assigned when the assignment device is not set.)

| | Label Name | Data Type | | Class | Assign (Device/Label) |
|---|---|---|---|---|---|
| 48 | bSetPositioningData_bEN | Bit | ... | VAR_GLOBAL | |
| 49 | bSetPositioningData_bENO | Bit | ... | VAR_GLOBAL | |
| 50 | bSetPositioningData_bOK | Bit | ... | VAR_GLOBAL | |
| 51 | bSetPositioningData_bErr | Bit | ... | VAR_GLOBAL | |
| 52 | uSetPositioningData_bErrId | Word [Unsigned]/Bit String [16-bit] | ... | VAR_GLOBAL | |
| 53 | bJOG_bENO | Bit | ... | VAR_GLOBAL | |
| 54 | bJOG_bOK | Bit | ... | VAR_GLOBAL | |
| 55 | bJOG_bErr | Bit | ... | VAR_GLOBAL | |
| 56 | uJOG_uErrId | Word [Unsigned]/Bit String [16-bit] | ... | VAR_GLOBAL | |
| 57 | bMPG_bENO | Bit | ... | VAR_GLOBAL | |
| 58 | bMPG_bOK | Bit | ... | VAR_GLOBAL | |
| 59 | bMPG_bErr | Bit | ... | VAR_GLOBAL | |
| 60 | uMPG_uErrId | Word [Unsigned]/Bit String [16-bit] | ... | VAR_GLOBAL | |
| 61 | bChangeSpeed_bENO | Bit | ... | VAR_GLOBAL | |
| 62 | bChangeSpeed_bOK | Bit | ... | VAR_GLOBAL | |
| 63 | bChangeSpeed_bErr | Bit | ... | VAR_GLOBAL | |
| 64 | uChangeSpeed_uErrId | Word [Unsigned]/Bit String [16-bit] | ... | VAR_GLOBAL | |
| 65 | bChangeAccDecTime_bENO | Bit | ... | VAR_GLOBAL | |
| 66 | bChangeAccDecTime_bOK | Bit | ... | VAR_GLOBAL | |
| 67 | bChangeAccDecTime_bErr | Bit | ... | VAR_GLOBAL | |
| 68 | uChangeAccDecTime_uErrId | Word [Unsigned]/Bit String [16-bit] | ... | VAR_GLOBAL | |
| 69 | bChangePosition_bENO | Bit | ... | VAR_GLOBAL | |
| 70 | bChangePosition_bOK | Bit | ... | VAR_GLOBAL | |
| 71 | bChangePosition_bErr | Bit | ... | VAR_GLOBAL | |
| 72 | uChangePosition_uErrId | Word [Unsigned]/Bit String [16-bit] | ... | VAR_GLOBAL | |
| 73 | bRestart_bENO | Bit | ... | VAR_GLOBAL | |
| 74 | bRestart_bOK | Bit | ... | VAR_GLOBAL | |
| 75 | bRestart_bErr | Bit | ... | VAR_GLOBAL | |
| 76 | uRestart_uErrId | Word [Unsigned]/Bit String [16-bit] | ... | VAR_GLOBAL | |
| 77 | bInitializeParameter_bENO | Bit | ... | VAR_GLOBAL | |
| 78 | bInitializeParameter_bOK | Bit | ... | VAR_GLOBAL | |
| 79 | bInitializeParameter_bErr | Bit | ... | VAR_GLOBAL | |
| 80 | uInitializeParameter_uErrId | Word [Unsigned]/Bit String [16-bit] | ... | VAR_GLOBAL | |
| 81 | bOperateError_bENO | Bit | ... | VAR_GLOBAL | |
| 82 | bOperateError_bOK | Bit | ... | VAR_GLOBAL | |
| 83 | bOperateError_bModuleErr | Bit | ... | VAR_GLOBAL | |
| 84 | uOperateError_uModuleErrId | Word [Unsigned]/Bit String [16-bit] | ... | VAR_GLOBAL | |
| 85 | bOperateError_bModuleWarn | Bit | ... | VAR_GLOBAL | |
| 86 | uOperateError_bModuleWarnId | Word [Unsigned]/Bit String [16-bit] | ... | VAR_GLOBAL | |
| 87 | bOperateError_bErr | Bit | ... | VAR_GLOBAL | |
| 88 | uOperateError_uErrId | Word [Unsigned]/Bit String [16-bit] | ... | VAR_GLOBAL | |
| 89 | bWriteFlash_bENO | Bit | ... | VAR_GLOBAL | |
| 90 | bWriteFlash_bOK | Bit | ... | VAR_GLOBAL | |
| 91 | bWriteFlash_bErr | Bit | ... | VAR_GLOBAL | |
| 92 | uWriteFlash_uErrId | Word [Unsigned]/Bit String [16-bit] | ... | VAR_GLOBAL | |
| 93 | bBasicParamSetComp | Bit | ... | VAR_GLOBAL | |
| 94 | bSetElectronicGear16bit | Bit | ... | VAR_GLOBAL | |
| 95 | bOPRParamSetComp | Bit | ... | VAR_GLOBAL | |
| 96 | uBlockData | Word [Unsigned]/Bit String [16-bit](0..4) | ... | VAR_GLOBAL | |
| 97 | uBlockInstData | Word [Unsigned]/Bit String [16-bit](0..4) | ... | VAR_GLOBAL | |
| 98 | bOPRReqFlagOffReq_P | Bit | ... | VAR_GLOBAL | |
| 99 | bOPRReqFlagOffReq_H | Bit | ... | VAR_GLOBAL | |
| 100 | bOPRReqFlagOffReq | Bit | ... | VAR_GLOBAL | |
| 101 | udMovementAmount | Double Word [Unsigned]/Bit String [32-bit] | ... | VAR_GLOBAL | |
| 102 | udSpeed | Double Word [Signed] | ... | VAR_GLOBAL | |
| 103 | bStartPositioning_bENO | Bit | ... | VAR_GLOBAL | |
| 104 | bStartPositioning_bOK | Bit | ... | VAR_GLOBAL | |
| 105 | bStartPositioning_bErr | Bit | ... | VAR_GLOBAL | |
| 106 | uStartPositioning_uErrId | Word [Unsigned]/Bit String [16-bit] | ... | VAR_GLOBAL | |
| 107 | bDuringMPGOperation | Bit | ... | VAR_GLOBAL | |
| 108 | bFastStartPreparationComp | Bit | ... | VAR_GLOBAL | |
| 109 | bFastOPRStartReq | Bit | ... | VAR_GLOBAL | |
| 110 | bFastOPRStartReq_H | Bit | ... | VAR_GLOBAL | |
| 111 | bDuringJogInchingOperation | Bit | ... | VAR_GLOBAL | |
| 112 | udJogOperationSpeed | Double Word [Unsigned]/Bit String [32-bit] | ... | VAR_GLOBAL | |
| 113 | uInchingMovementAmount | Word [Unsigned]/Bit String [16-bit] | ... | VAR_GLOBAL | |
| 114 | bChangeSpeedReq | Bit | ... | VAR_GLOBAL | |
| 115 | bOverrideReq_P | Bit | ... | VAR_GLOBAL | |
| 116 | bAccDecTimeChangeReq | Bit | ... | VAR_GLOBAL | |
| 117 | bChangeAccDecTime_iEnable | Bit | ... | VAR_GLOBAL | |
| 118 | bStepOperationReq_P | Bit | ... | VAR_GLOBAL | |
| 119 | bChangeTorqueReq | Bit | ... | VAR_GLOBAL | |
| 120 | bSkipReq_P | Bit | ... | VAR_GLOBAL | |
| 121 | bSkipReq | Bit | ... | VAR_GLOBAL | |
| 122 | bTeachingReq_P | Bit | ... | VAR_GLOBAL | |
| 123 | bTeachingReq | Bit | ... | VAR_GLOBAL | |
| 124 | uTeachingData | Word [Unsigned]/Bit String [16-bit](0..3) | ... | VAR_GLOBAL | |
| 125 | uTeachingDevice | Bit(0..1) | ... | VAR_GLOBAL | |
| 126 | uIO | Word [Unsigned]/Bit String [16-bit] | ... | VAR_GLOBAL | |
| 127 | bStopContinuousOperationReq_P | Bit | ... | VAR_GLOBAL | |
| 128 | bTargetPositionChangeReq | Bit | ... | VAR_GLOBAL | |
| 129 | bRestartReq | Bit | ... | VAR_GLOBAL | |

| | Label Name | Data Type | | Class | Assign (Device/Label) |
|---|---|---|---|---|---|
| 130 | bInitializeParameterReq | Bit | ... | VAR_GLOBAL | |
| 131 | bWriteFlashReq | Bit | ... | VAR_GLOBAL | |
| 132 | bErrResetReq | Bit | ... | VAR_GLOBAL | |
| 133 | bStopReq_P | Bit | ... | VAR_GLOBAL | |
| 134 | bABRSTReq | Bit | ... | VAR_GLOBAL | |
| 135 | uOperateError_bModuleErrId | Word [Unsigned]/Bit String [16-bit] | ... | VAR_GLOBAL | |
| 136 | bErrReadReq | Bit | ... | VAR_GLOBAL | |
| 137 | bPositioningStartReq | Bit | ... | VAR_GLOBAL | |
| 138 | bABRSTReq_P | Bit | ... | VAR_GLOBAL | |
| 139 | bABRST_bENO | Bit | ... | VAR_GLOBAL | |
| 140 | bABRST_bOK | Bit | ... | VAR_GLOBAL | |
| 141 | bABRST_bAbsNG | Bit | ... | VAR_GLOBAL | |
| 142 | uABRST_uAbsErrId | Word [Unsigned]/Bit String [16-bit] | ... | VAR_GLOBAL | |
| 143 | bABRST_bErr | Bit | ... | VAR_GLOBAL | |
| 144 | uABRST_uErrId | Word [Unsigned]/Bit String [16-bit] | ... | VAR_GLOBAL | |
| 145 | bPosiStart10 | Bit | ... | VAR_GLOBAL | |
| 146 | uPositioningStartNo | Word [Unsigned]/Bit String [16-bit] | ... | VAR_GLOBAL | |

# 13.3 Creating a Program



The "positioning control operation program" actually used is explained in this section.

## General configuration of program

The general configuration of the positioning control operation program is shown below.

| No. | Program name | Remark |
|---|---|---|
| 1a | Basic parameter setting | • The program is not required when the parameter, positioning data, block start data, and servo parameter are set using an engineering tool.<br>• The setting of the home position return parameters is not required when the machine home position return control is not executed. |
| 1b | Home position return parameter setting program | |
| 1c | Unit "degree" setting program | |
| 2 | Positioning data setting program | |
| 3 | Block start data setting program | |
| 4 | Servo parameter setting program | |
| 5 | Home position return request OFF program | Not required when the fast home position return is executed. |
| 6 | External command function valid setting program | — |
| 7 | PLC READY signal ON program | |
| 8 | All axis servo ON program | |
| 9 | Positioning start number setting program | |
| 10 | Positioning start program | — |
| 11 | M code OFF program | Not required when the M code output function is not used. |
| 12 | JOG operation setting program | Not required when the JOG operation is not used. |
| 13 | Inching operation setting program | Not required when the inching operation is not used. |
| 14 | JOG operation/inching operation execution program | Not required when the JOG operation or the inching operation is not used. |
| 15 | Manual pulse generator operation program | Not required when the manual pulse generator operation is not used. |
| 16 | Speed change program | Add the program as necessary. |
| 17 | Override program | |
| 18 | Acceleration/deceleration time change program | |
| 19 | Torque change program | |
| 20 | Step operation program | |
| 21 | Skip program | |
| 22 | Teaching program | |
| 23 | Continuous operation interrupt program | |
| 24 | Target position change program | |
| 25 | Restart program | |
| 26 | Parameter initialization program | |
| 27 | Flash ROM write program | |
| 28 | Error reset program | |
| 29 | Axis stop program | — |

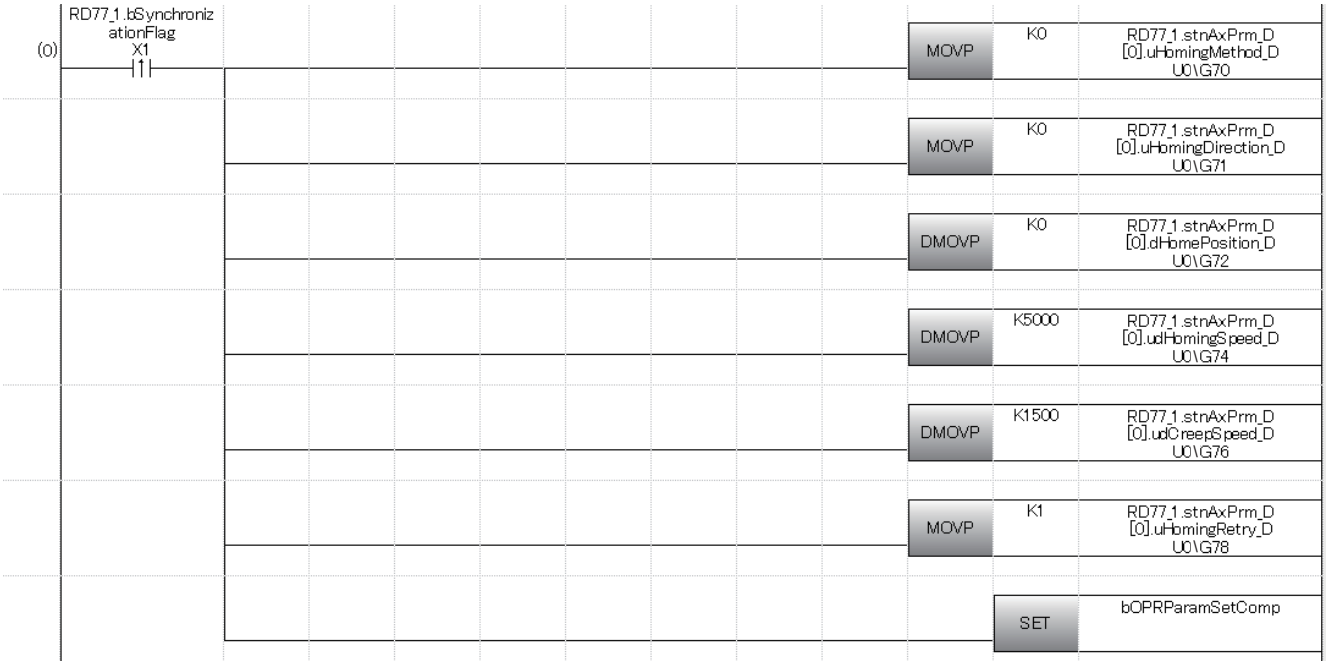
# 13.4 Positioning Program Examples

## Parameter setting program

The program is not required when the parameter is set by "Module Parameter" using an engineering tool.

### ■Setting for basic parameter 1 (axis 1)

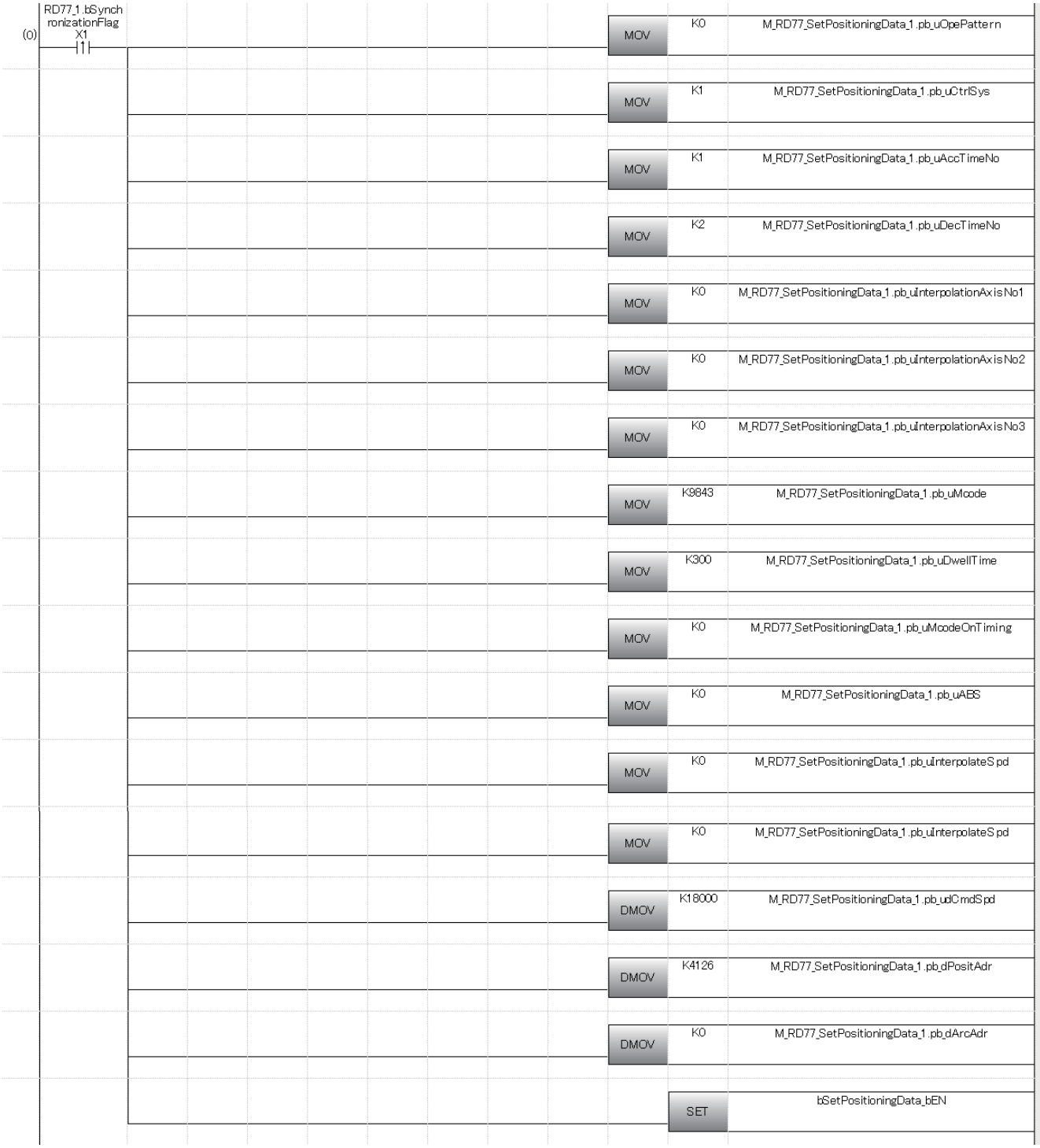
### ■Setting for home position return basic parameter (axis 1)

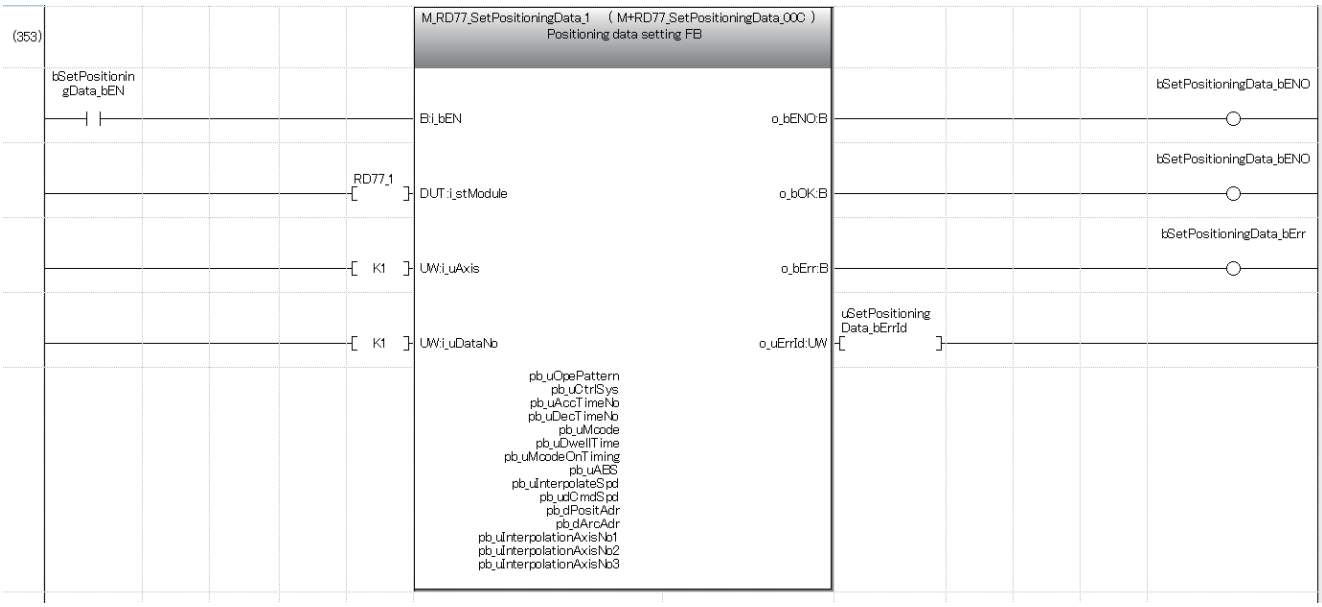



### ■Unit "degree" setting (axis 1) program

## Positioning data setting program

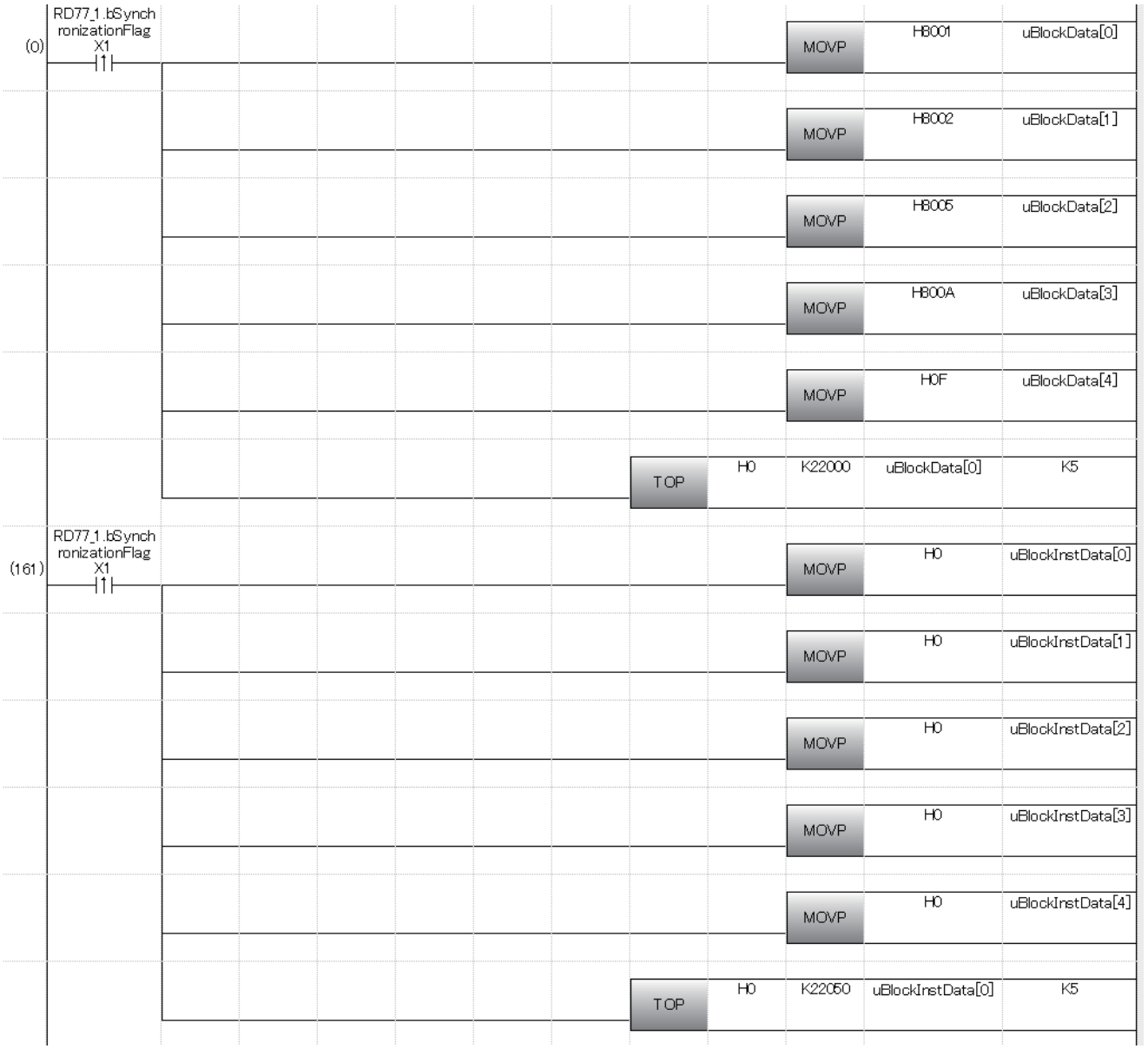
The program is not required when the data is set by "Positioning Data" using an engineering tool.





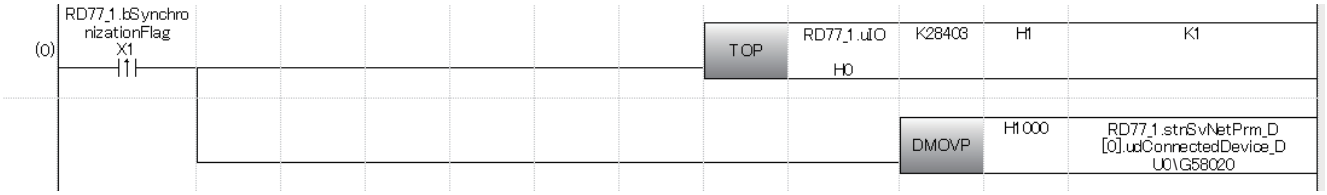

## Block start data setting program

The program is not required when the data is set by "Block Start Data" using an engineering tool.



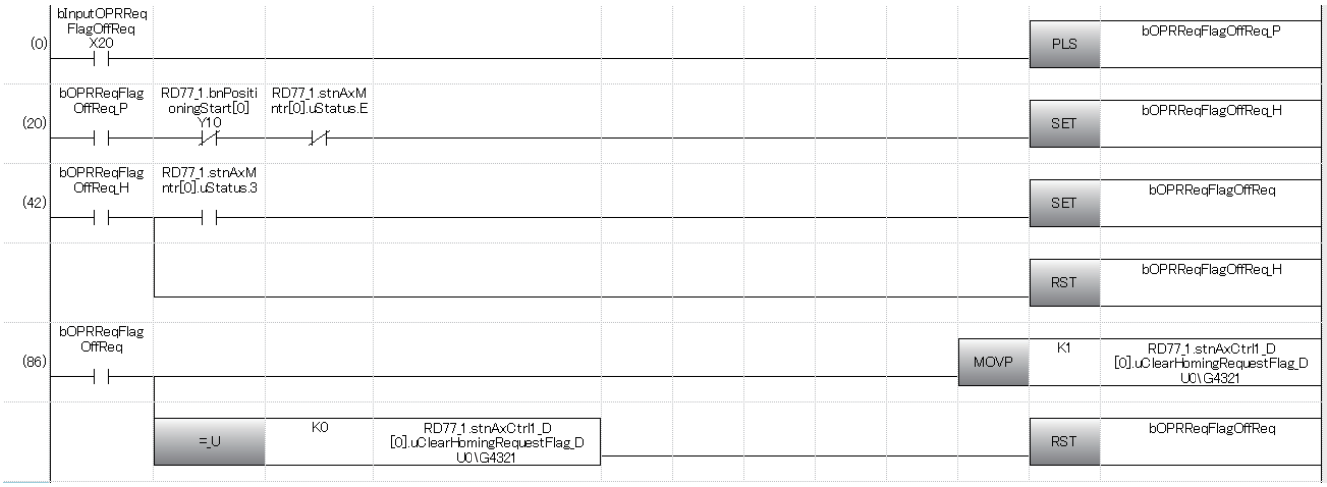
## Servo parameter setting program

The program is not required when the parameter is set by "Servo Parameter" using an engineering tool.

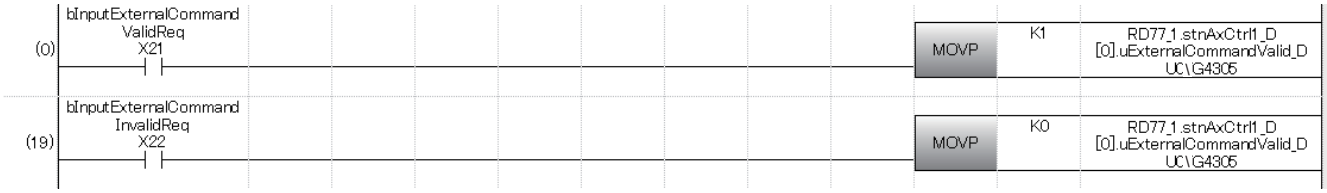



## Home position return request OFF program

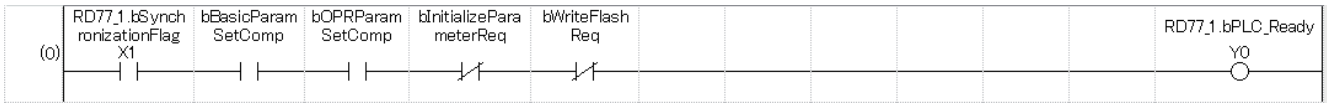
The program is not required when "1: Positioning control is executed." is set in "[Pr.55] Operation setting for incompletion of home position return" by "Home Position Return Detailed Parameters" using an engineering tool.




## External command function valid setting program




## PLC READY signal ON program




## All axis servo ON program

## Positioning start number setting program

### ■Machine home position return

### ■Fast home position return

### ■Positioning with positioning data No.1

### ■Speed-position switching operation (Positioning data No.2)

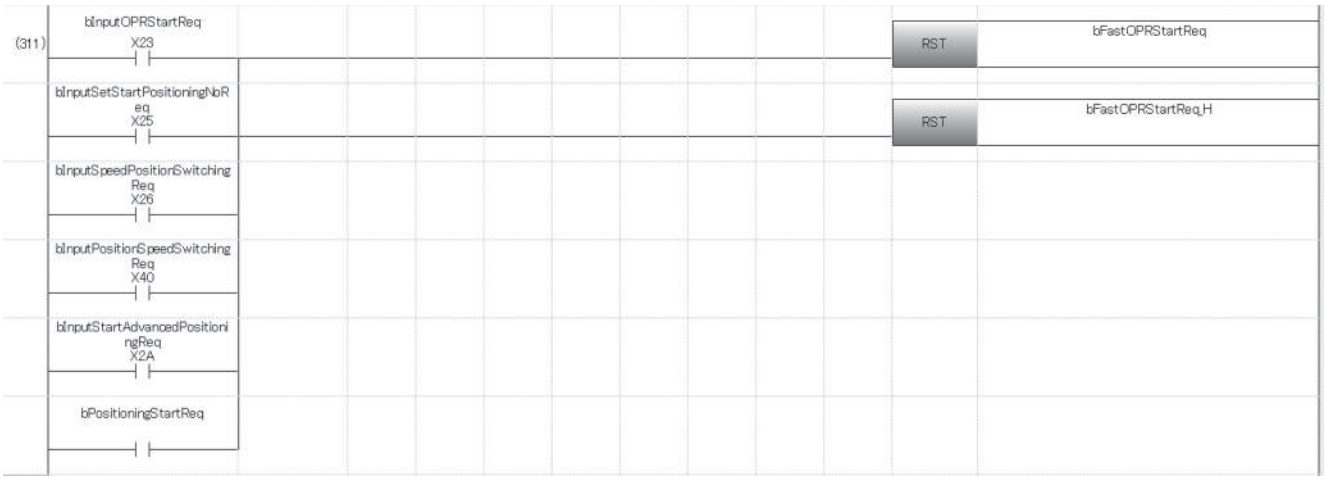
In the ABS mode, new movement amount is not needed to be written.

### ■Position-speed switching operation (Positioning data No.3)

### ■High-level positioning control

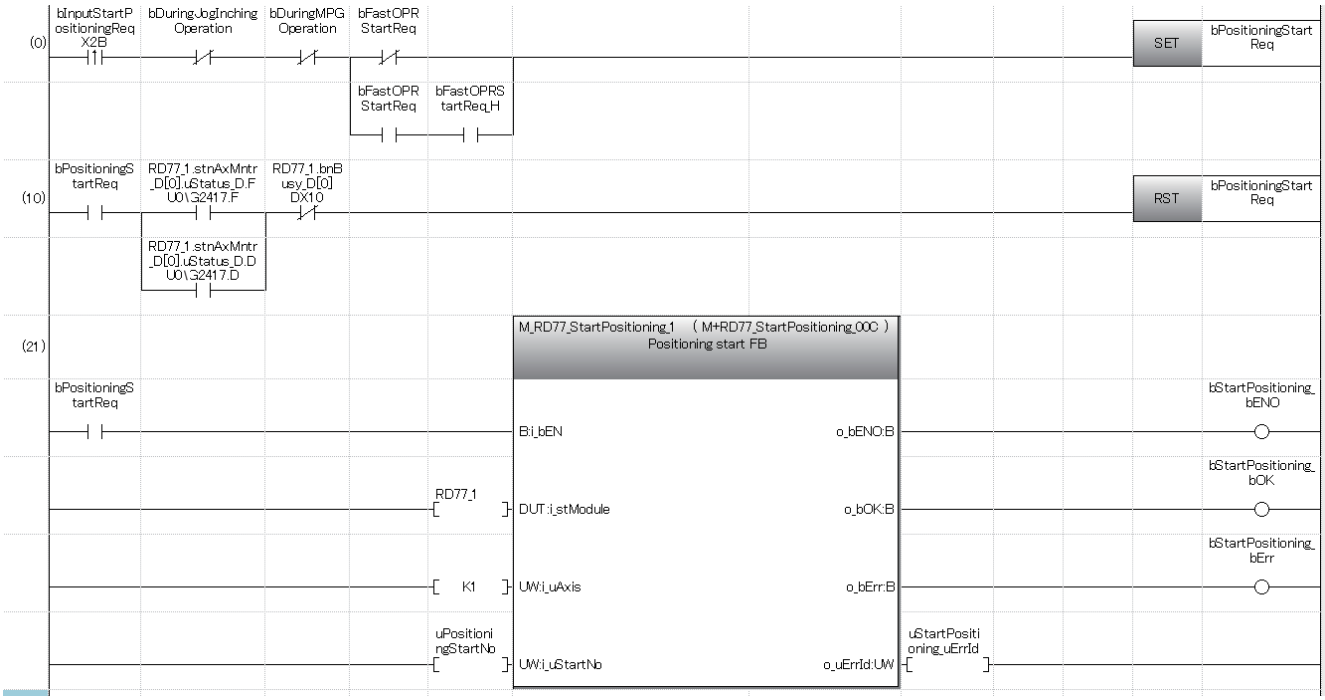
### ■Fast home position return command and fast home position return command storage OFF

Not required when fast home position return is not used.



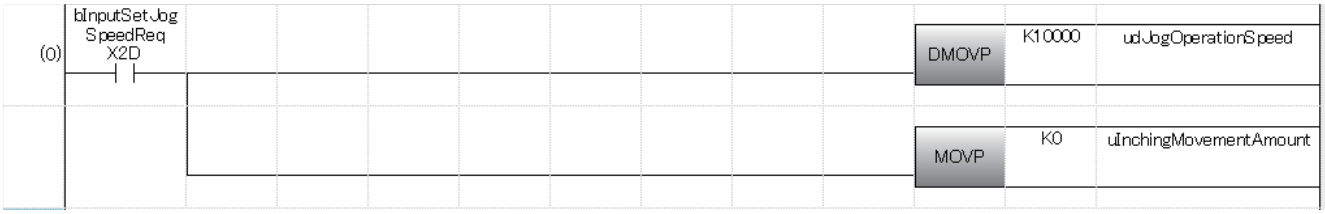



## Positioning start program



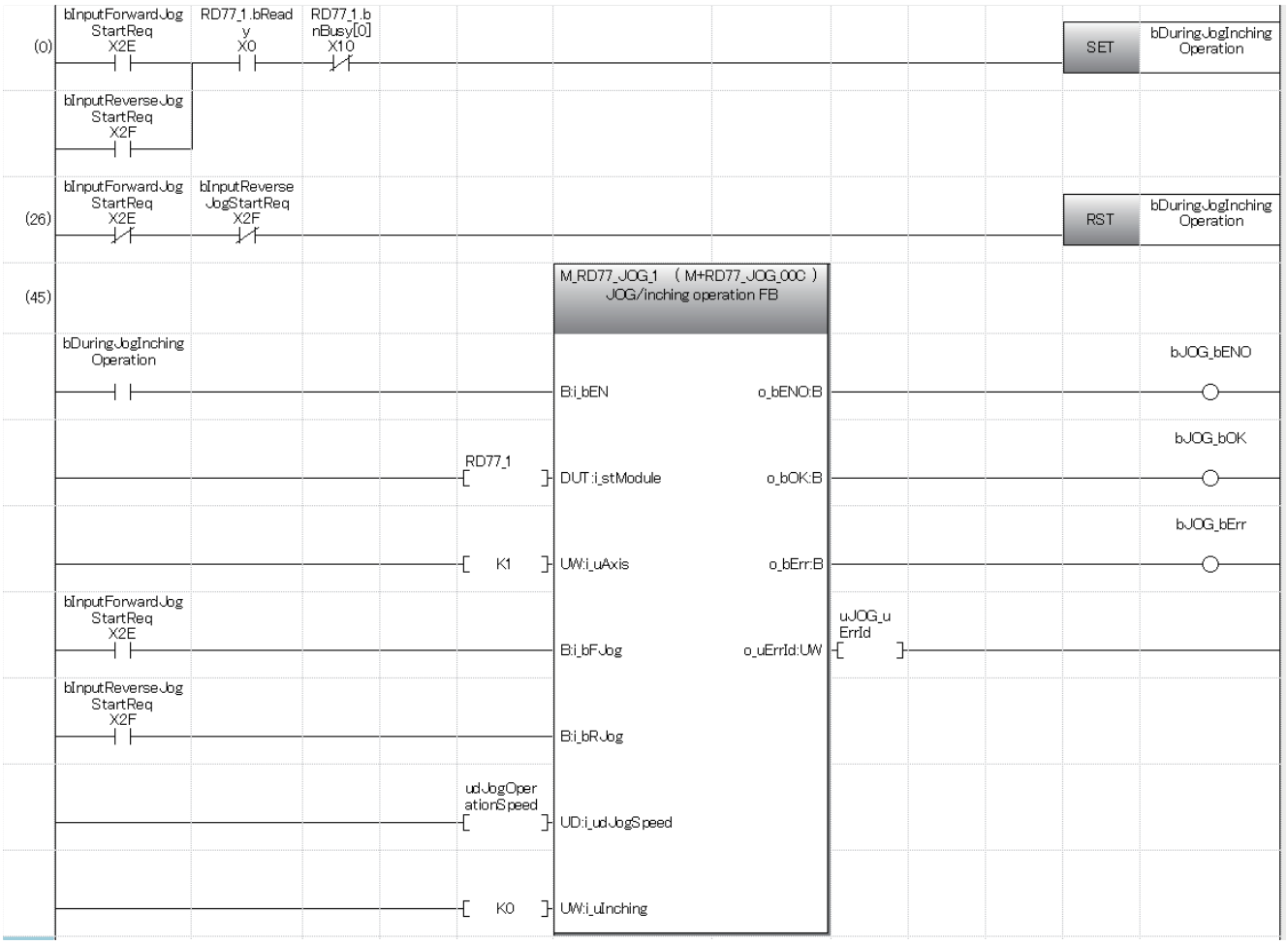

## M code OFF program

## JOG operation setting program

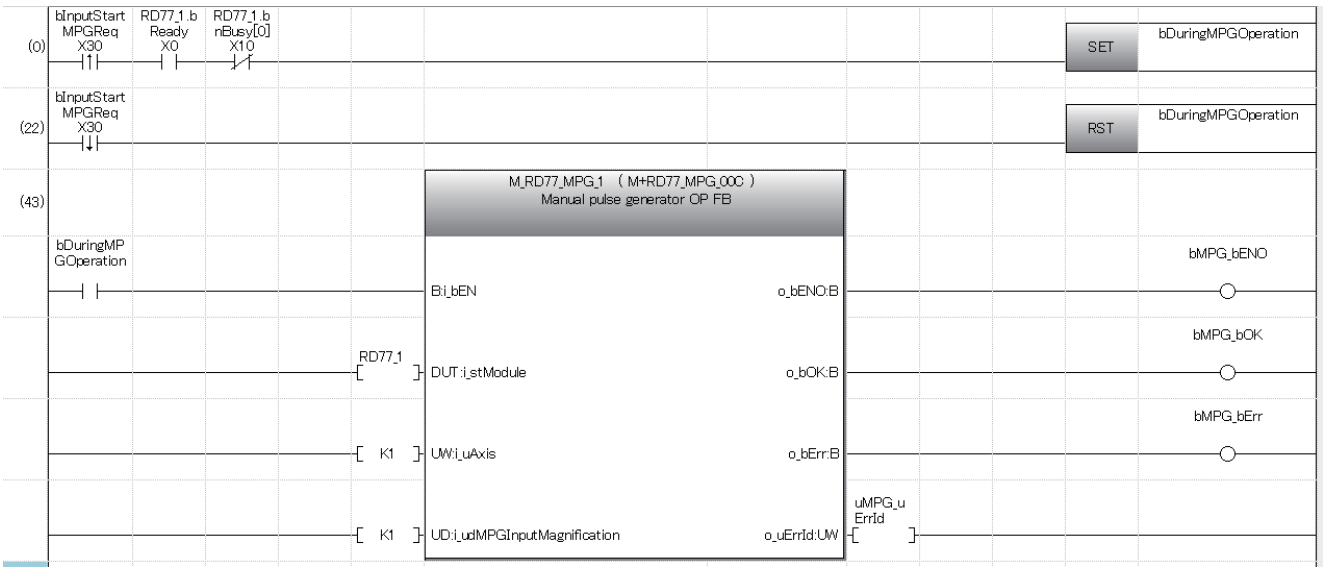


## Inching operation setting program

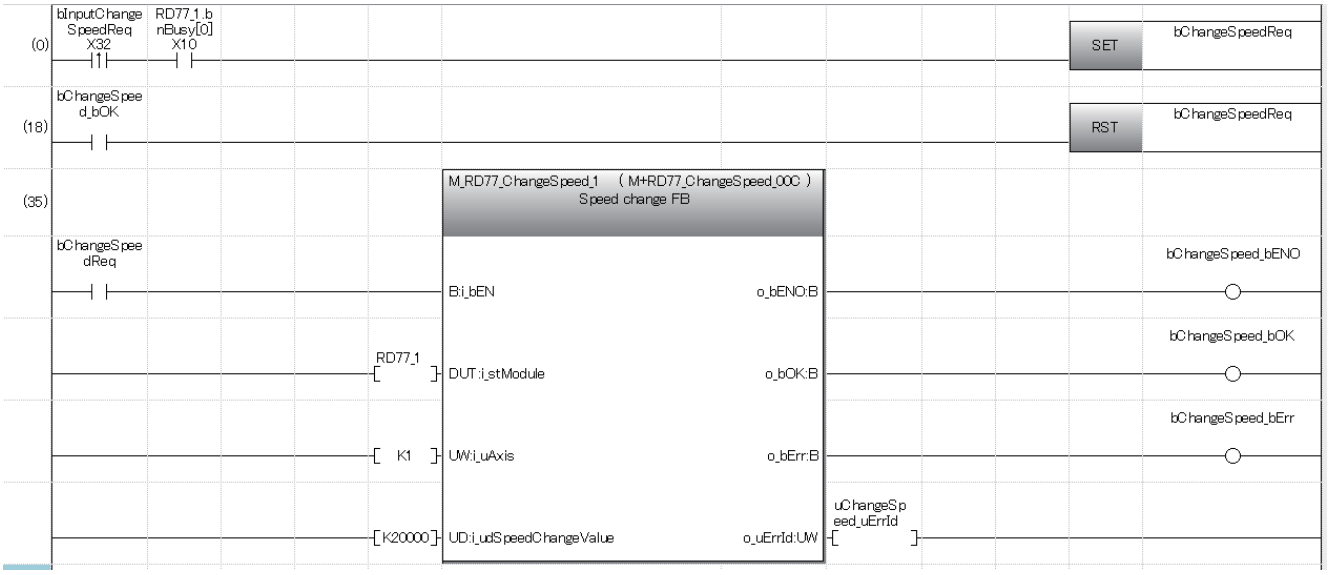
## JOG operation/inching operation execution program



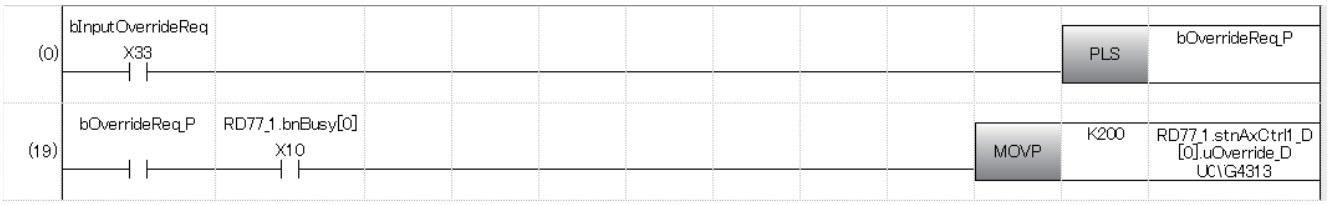

## Manual pulse generator operation program



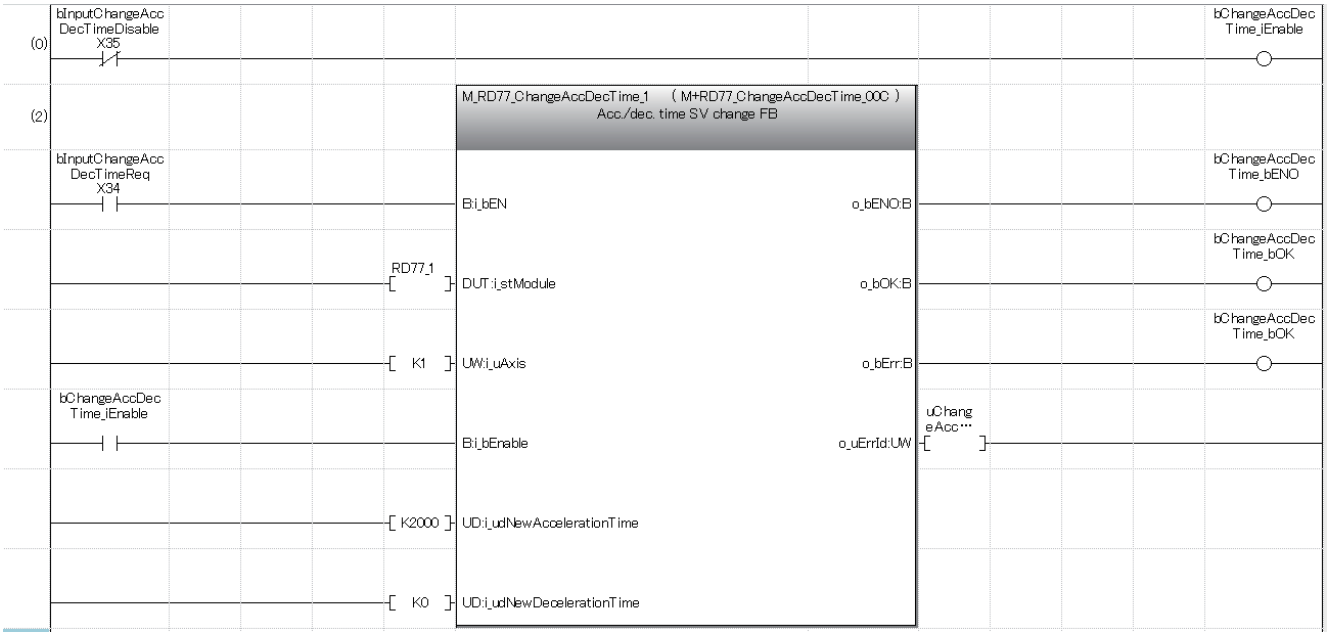
## Speed change program



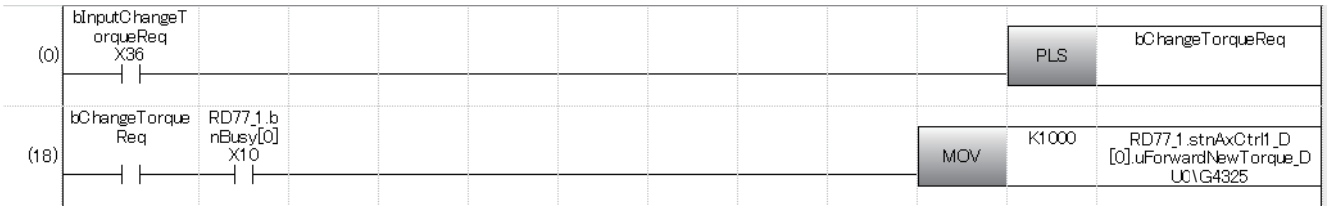

## Override program



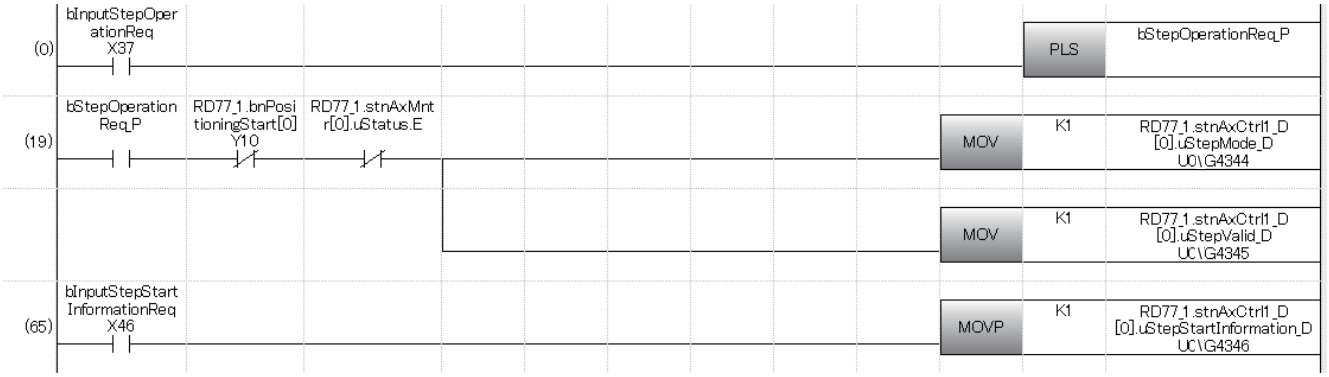

## Acceleration/deceleration time change program



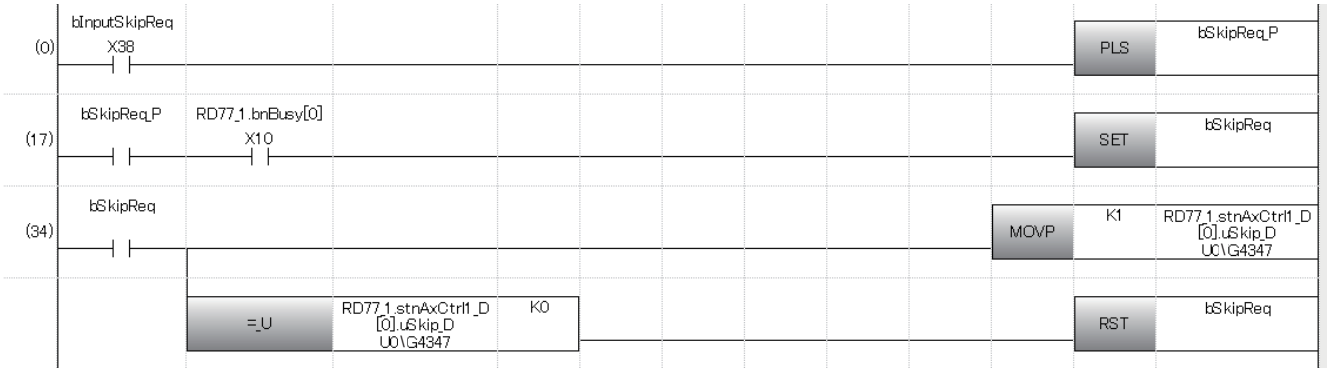
## Torque change program



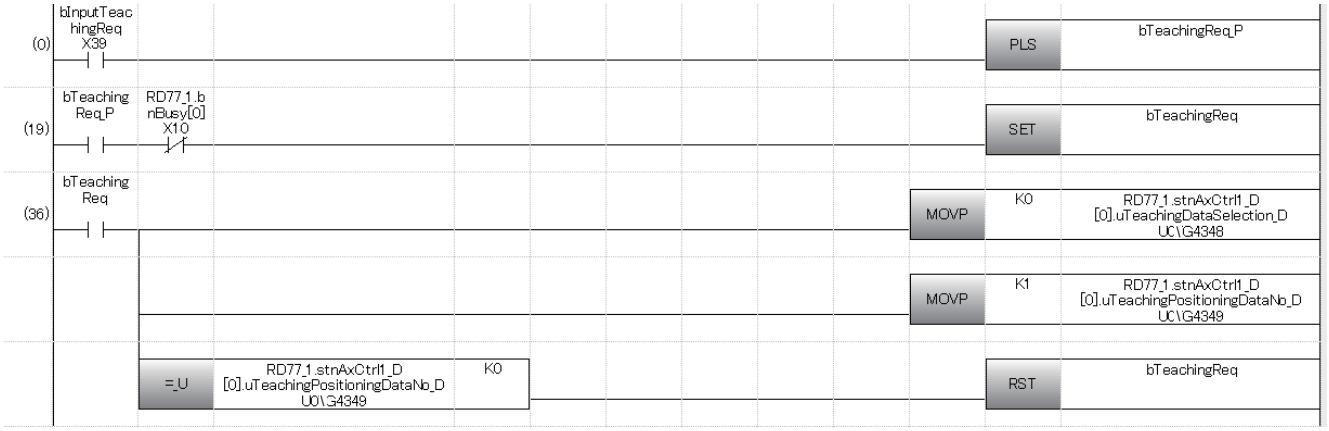

## Step operation program




## Skip program

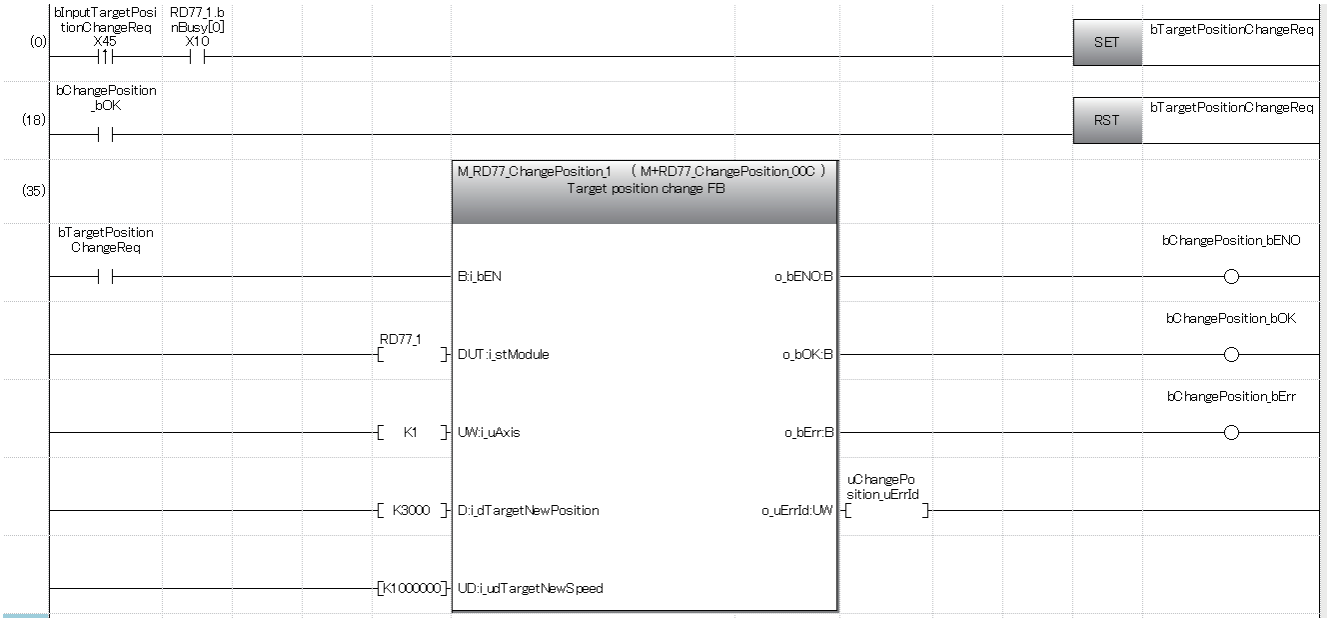



## Teaching program

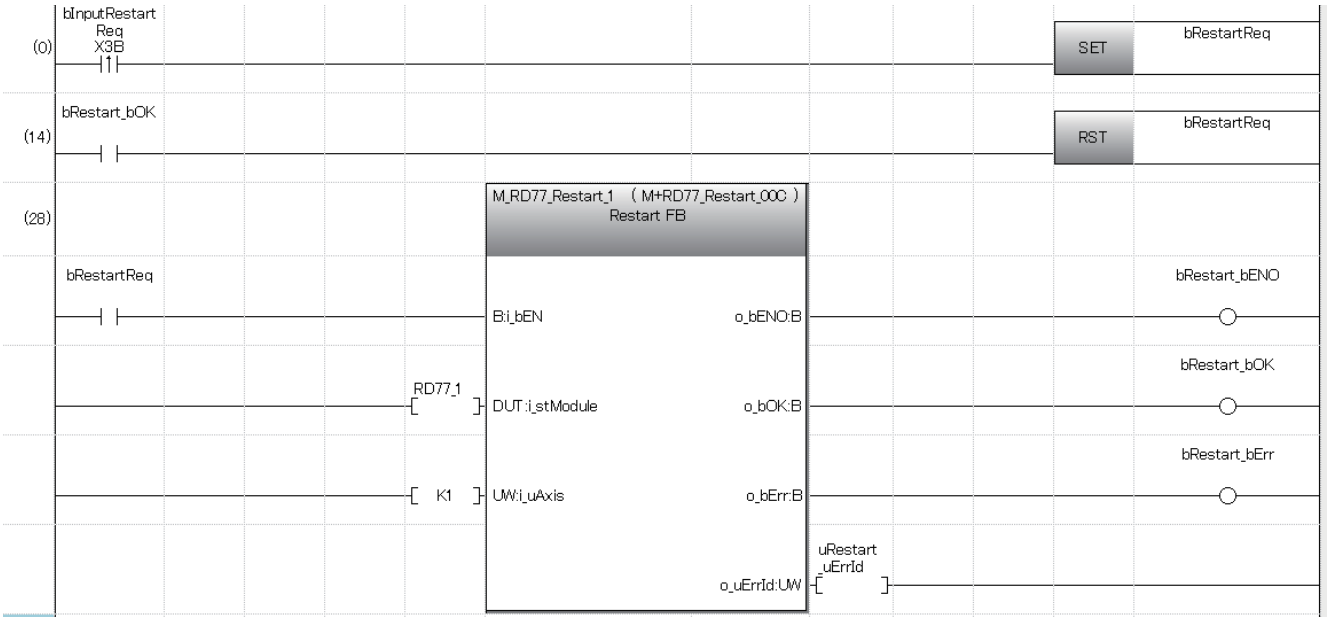


## Continuous operation interrupt program

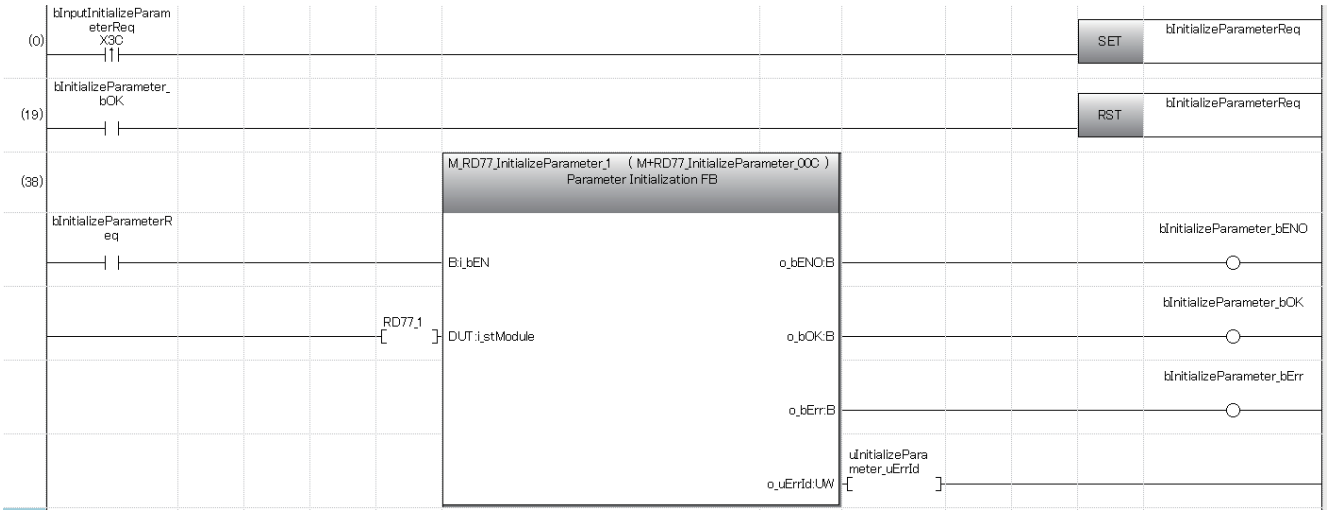
## Target position change program



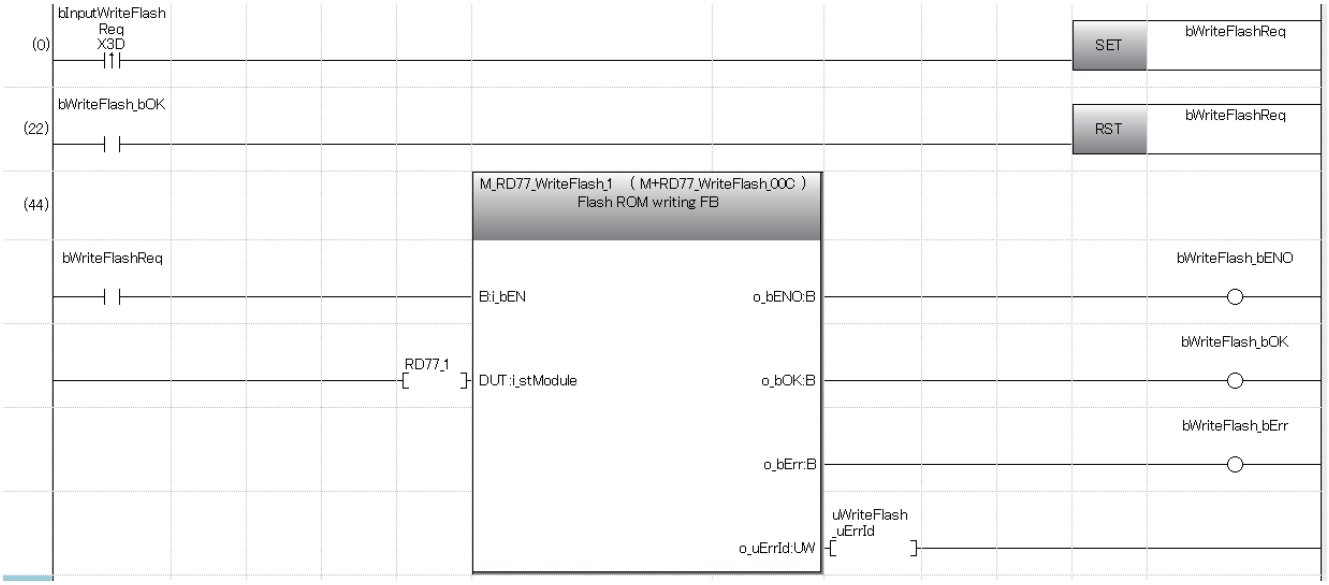

## Restart program



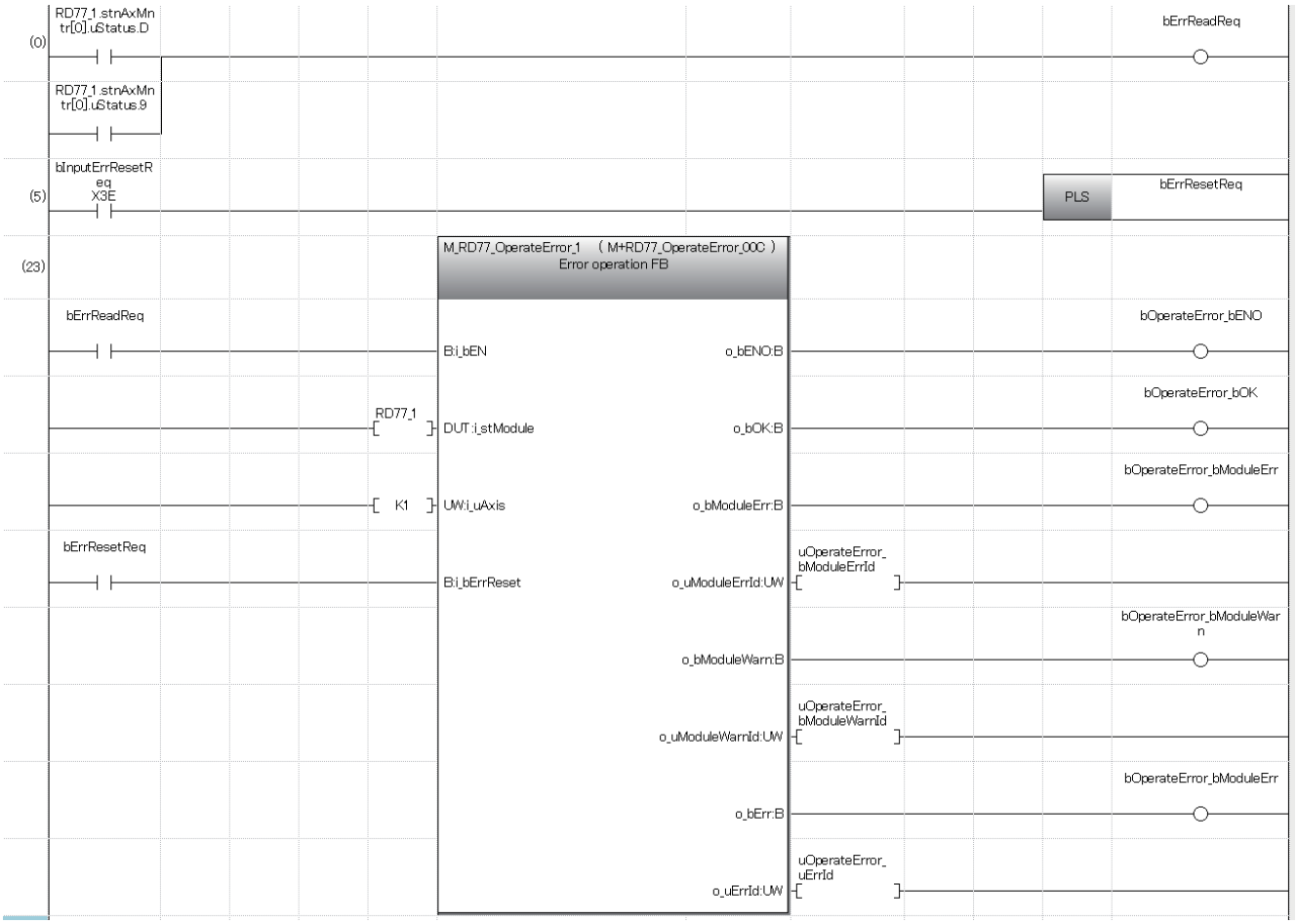
## Parameter initialization program



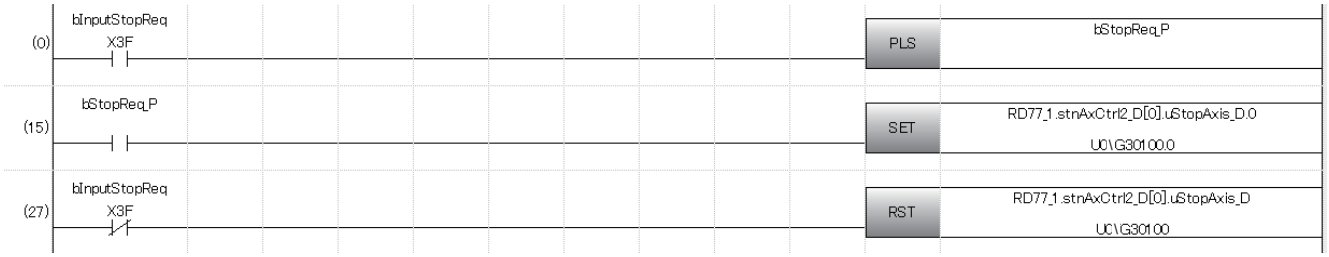

## Flash ROM write program



## Error reset program




## Axis stop program



# 14 TROUBLESHOOTING

This chapter describes details of error occurred by using the Simple Motion module and troubleshooting.

## 14.1 Troubleshooting Procedure

When a trouble occurs, execute the troubleshooting in the order shown below.

***1.*** Check that each module is mounted correctly.
(📖MELSEC iQ-R Module Configuration Manual)

***2.*** Check the LEDs of the power supply module and CPU module.
(📖MELSEC iQ-R CPU Module User's Manual (Startup))

***3.*** Check the LED status of each module to confirm whether an error does not occur in a module. (☞ Page 574 Troubleshooting using the LEDs)

***4.*** Check whether an error does not occur in a module using the module diagnostics of an engineering tool. (☞ Page 576 Troubleshooting using the module status)

### Troubleshooting using the LEDs

Primary diagnostics can be executed without the engineering tool by checking the status of the LED display, so that the range of the trouble cause can be reduced.
The status of the Simple Motion module can be checked by the RUN LED and ERR LED. The following shows the correspondence relation between each LED and status of the Simple Motion module.
☐: OFF, ■: ON, ●: Flashing

| RD77MS status | LED display | | Description | Remedy |
|---|---|---|---|---|
| Normal operation | RUN ■<br>ERR ☐ | AX1 ☐<br>AX2 ☐<br>AX3 ☐<br>AX4 ☐ | The axes stopped<br>The axes on standby | — |
| | | AX1-8 ☐*1 | | |
| | | AX1-16 ☐*1 | | |
| | RUN ■<br>ERR ☐ | AX1 ■<br>AX2 ☐<br>AX3 ☐<br>AX4 ☐ | The axis in operation | Turned ON from the positioning start until the axis stops caused by completion, stop, or an error. (One-to-one correspondence with the BUSY signal.) |
| | | AX1-8 ■*2 | | |
| | | AX1-16 ■*2 | | |
| Operation failure | RUN ■<br>ERR ■ | AX1 ●<br>AX2 ☐<br>AX3 ☐<br>AX4 ☐ | Minor error | Check the error code on the module diagnosis or event history using the engineering tool, and take a measure against the error referring to the list of error codes. |
| | | AX1-8 ●*3 | | |
| | | AX1-16 ●*3 | | |
| | RUN ■<br>ERR ● | AX1 ☐<br>AX2 ☐<br>AX3 ☐<br>AX4 ☐ | Moderate error<br>Watchdog timer error | If the RUN LED is not ON after the power is turned ON from OFF, the module might be faulty. Therefore, it is required to exchange the module. |
| | | AX1-8 ☐ | | |
| | | AX1-16 ☐ | | |

| RD77MS status | LED display | | Description | Remedy |
|---|---|---|---|---|
| Online module change | RUN ● ERR ☐ | AX1 ☐ AX2 ☐ AX3 ☐ AX4 ☐ | Module remove selection in operation | — |
| | | AX1-8 ☐ | | |
| | | AX1-16 ☐ | | |
| | RUN ☐ ERR ☐ | AX1 ☐ AX2 ☐ AX3 ☐ AX4 ☐ | Module change in operation | — |
| | | AX1-8 ☐ | | |
| | | AX1-16 ☐ | | |

*1 When all axes are stopped or on standby, the AX LED turns OFF.
*2 When any of the axes is in operation, the AX LED turns ON.
*3 When an error occurs in any of the axes, the AX LED is flashing.

## When the RUN LED turns off

| Check item | Action |
|---|---|
| Is the power supplied for the power supply module? | Check that the voltage supplied to the power supply module is within the rated range. |
| Is the LED of the power supply module turned on? | If the LED is not turned on, refer to the following.<br>📖MELSEC iQ-R CPU Module User's Manual (Application) |
| Is the power supply capacity sufficient? | Calculate the total current consumption of the modules connected with the base unit (CPU module, I/O modules, and intelligent function modules) and check that the power supply capacity is not insufficient. |
| Is the module connected with the base unit correctly? | Check the state of connection with the module. |

If there is no problem on the above check items, a hardware failure may have occurred. Reset the CPU module and check that the RUN LED turns on.
If not, the possible cause is a hardware failure. Please consult your local Mitsubishi representative, explaining a detailed description of the problem.

## When the ERR LED flashes

| Check item | Action |
|---|---|
| Is there a moderate error? | • An error may have occurred in the CPU module. Check the error occurred in the CPU module and take a corrective action.<br>• A hardware failure may have occurred. Reset the CPU module and check that the RUN LED turns on. If not, the possible cause is a hardware failure. Please consult your local Mitsubishi representative, explaining a detailed description of the problem. |

## When the ERR LED turns on and AX LED flashes

| Check item | Action |
|---|---|
| Is there a minor error? | Check the error code and take a corrective action. |

## When the ERR LED turns on

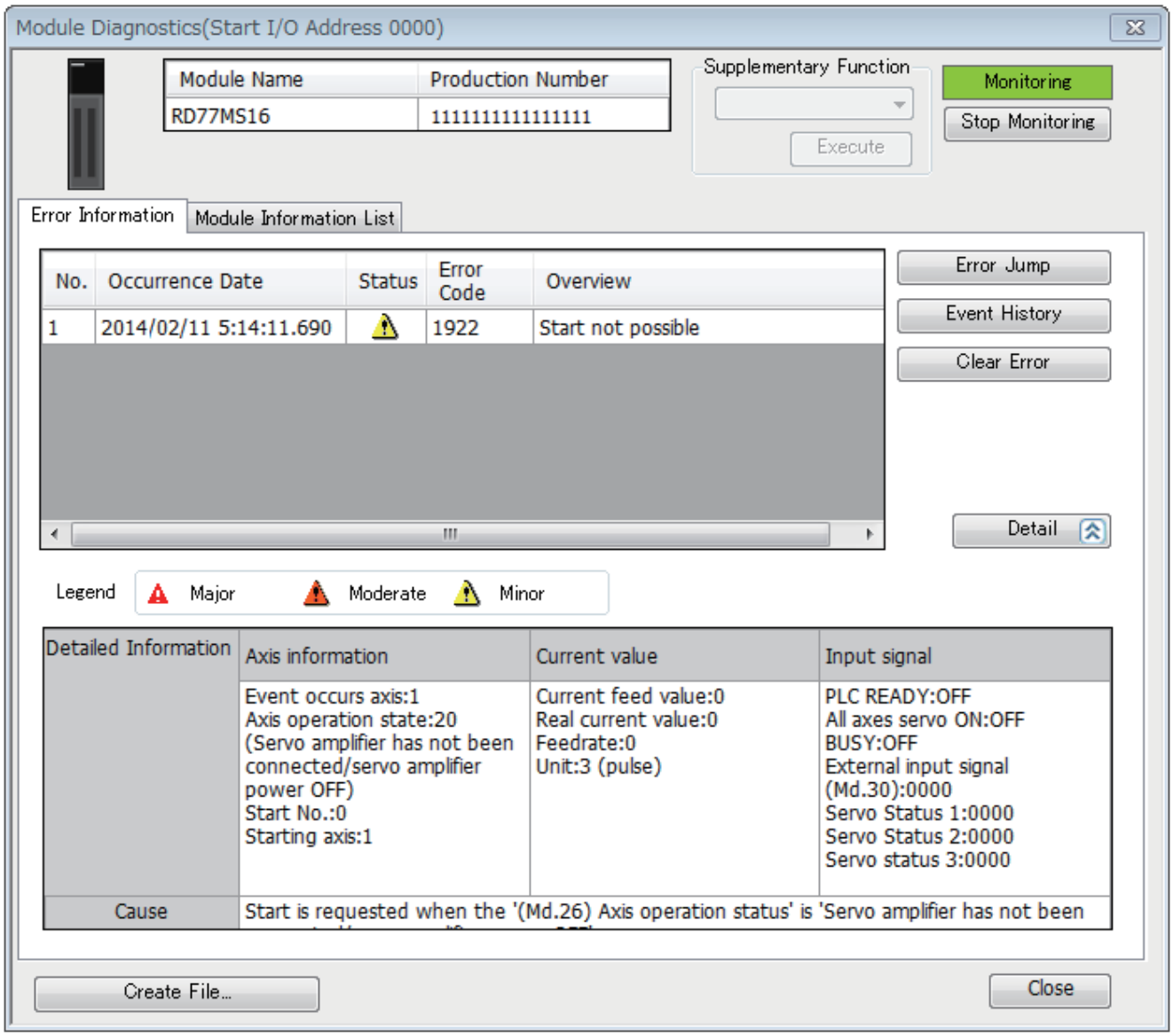
| Check item | Action |
|---|---|
| Is there a synchronous encoder axis error? | Check the error code and take a corrective action. |

## Other than those above

Reset the CPU module and check that the module is in the normal status.
If the status is not changed, the possible cause is a hardware failure. Please consult your local Mitsubishi representative, explaining a detailed description of the problem.

# Troubleshooting using the module status

Error codes (warning codes) and error history occurred in the Simple Motion module can be checked on the module diagnostics display of an engineering tool.



# 14.2 Troubleshooting by Symptom

## Troubleshooting when a motor does not rotate

Check items and corrective actions for troubleshooting when a motor does not rotate are described below.

| Check item | Action |
|---|---|
| Is the PLC READY signal turned ON? | Review the program to turn ON the PLC READY signal. |
| Is the servo amplifier powered ON? | Power on the servo amplifier. |
| Is there an error in the servo amplifier? | Check the error code of the servo amplifier and take a corrective action. |
| Is the wiring between the Simple Motion module and servo amplifier correct? | Check the wiring between the Simple Motion module and servo amplifier, and correct it. |
| Is the wiring between the servo amplifier and motor correct? | Check the wiring between the servo amplifier and motor, and correct it. |
| Is the wiring of the limit signal correct? | Check the wiring and logic setting of the limit signal, and correct the wiring. |
| Is there an error in the Simple Motion module? (ERR LED is on or flashing) | Check the error code and take a corrective action. |
| Isn't the value in "[Md.26] Axis operation status" "1: stopped"? | • Review the stop program.<br>• Review whether the stop signal (STOP) is not input erroneously. |
| Is the value in "[Md.20] Current feed value" changed after positioning control is performed? | Review the start program. |
| Is the cumulative pulse of servo amplifier changed after positioning control is performed? | Refer to each servo amplifier instruction manual and check that the function to suppress the motor rotation is not working. |

If a motor does not rotate even after the above items are checked, the possible cause is a hardware failure.

Please consult your local Mitsubishi representative, explaining a detailed description of the problem.

## Troubleshooting when a motor does not rotate as intended.

Check items and corrective actions for troubleshooting when a motor does not rotate as intended are described below.

### ■When a motor rotates only in the opposite direction

| Check item | Action |
|---|---|
| Is the value in "Rotation direction selection/travel direction selection (PA14)" correct? | Check that the value in "Rotation direction selection/travel direction selection (PA14)" matches the settings of servo amplifier. When "Rotation direction selection/travel direction selection (PA14)" has been changed, turn the servo amplifier power supply ON again from OFF or reset the controller, and execute the home position return. |

### ■When a motor does not rotate at the set speed

| Check item | Action |
|---|---|
| Does the value in "[Md.28] Axis feedrate"*1 indicate the set speed? | [When "[Md.28] Axis feedrate"*1 indicates the set speed]<br>• Check that the values in "[Pr.2] Number of pulses per rotation (AP)", "[Pr.3] Movement amount per rotation (AL)", and "[Pr.4] Unit magnification (AM)" meet the system.<br>• When the servo amplifier has the electronic gear function, check that the settings meet the system. |
| | [When "[Md.28] Axis feedrate"*1 does not indicate the set speed]<br>• Check that the speed is not limited by the value in "[Pr.8] Speed limit value".<br>• In the JOG operation, check that the speed is not limited by the value in "[Pr.31] JOG speed limit value".<br>• In the JOG operation, check that Forward run JOG start signal [Cd.181] and Reverse run JOG start signal [Cd.182] do not repeatedly turn ON and OFF. |

*1 Speed control mode and continuous operation to torque control mode: "[Md.122] Speed during command"

### ■When the set position is not reached

| Check item | Action |
|---|---|
| Does the value in "[Md.20] Current feed value" indicate the intended position when the motor stops? | [When the position set in "[Md.20] Current feed value" is reached]<br>• Check that the values in "[Pr.2] Number of pulses per rotation (AP)", "[Pr.3] Movement amount per rotation (AL)", and "[Pr.4] Unit magnification (AM)" meet the system.<br>• When the servo amplifier has the electronic gear function, check that the settings meet the system. |
| | [When the position set in "[Md.20] Current feed value" is not reached]<br>• Check that the motor is not stopped by Axis stop signal [Cd.180]. If a motor is stopped by the stop command, the value "1: stopped" is stored in "[Md.26] Axis operation status". |

# 14.3 Error and Warning Details

## Error type

Errors detected by the Simple Motion module include parameter setting range errors, errors at operation start or during operation and errors detected by servo amplifier.

### Simple Motion module detection parameter setting range errors

The parameters are checked when the power is turned ON and at the rising edge (OFF → ON) of the PLC READY signal [Y0]. An error will occur if there is a mistake in the parameter setting details at that time.
When this kind of error occurs, the READY signal [X0] does not turn ON.
To cancel this kind of error, set the correct value in the parameter for which the error occurred, and then turn ON the PLC READY signal [Y0].

### Simple Motion module detection errors at operation start or during operation

The errors that occur at operation start or during operation such as the positioning control, JOG operation, or manual pulse generator operation. If an axis error occurs during interpolation operation, the error code will be stored in both the reference axis and the interpolation axis.
Note that the axis error No. will be stored only in the reference axis during analysis of the positioning data set in each point of the positioning start data table in the following cases.

- When the interpolation axis is BUSY.
- When the error occurs in positioning data or parameters unrelated to interpolation control.

If the error occurs at the simultaneous start of a positioning operation, the axis error storage details will differ depending on whether the error occurred before or after the simultaneous start.

- If the error (illegal axis No., other axis BUSY, etc.) occurs before the simultaneous start, the error "Error before simultaneous start" (error code: 1990H to 1991H) will occur for the start axis.
- If the error (positioning data error, software stroke limit error, etc.) occurs after the simultaneous start, an error code corresponding to the axis in which the error occurred will be stored. Because a simultaneous start cannot be carried out due to this, the error "Simultaneous start not possible" (error code: 199EH) will be stored in all axes in which an error has not occurred.

The axis operation status will be displayed as "error occurring" for axes in which an error occurred.
If an error occurs during operation, any moving axes will deceleration stop, and their operation status will be displayed as "error occurring".
All axes will decelerate to a stop during interpolation operations, even if the error occurs in only one axis.

### Servo amplifier detection errors

The errors that occur when the hardware error of the servo amplifier or servo motor or the servo parameter error occurs.
The servo is turned off at the error occurrence and the axis stops.
Remove the error factor and reset the error, reset the controller, or turn the servo amplifier power supply ON again from OFF.

# Error code classification

| Item | Error code | Classification of errors |
|---|---|---|
| Minor errors | 1860H to 18BFH | Dedicated instruction errors |
| | 18C0H to 18FFH | Inter-module synchronization errors |
| | 1900H to 193FH | Positioning control common errors |
| | 1940H to 197FH | Home position return errors |
| | 1980H to 198FH | JOG, inching and manual pulse generator operation errors |
| | 1990H to 19EFH | Positioning operation errors |
| | 19F0H to 19FFH | Block start data errors |
| | 1A00H to 1A0FH | Condition data errors |
| | 1A10H to 1A5FH | Positioning data errors |
| | 1A60H to 1A9FH | Basic parameter errors |
| | 1AA0H to 1AFFH | Detailed parameter errors |
| | 1B00H to 1B3FH | Home position return parameter errors |
| | 1B40H to 1B9FH | Expansion/Common parameter errors |
| | 1BA0H to 1BDFH | Synchronous control input axis errors |
| | 1BE0H to 1C3FH | Synchronous control output axis errors |
| | 1C80H to 1CBFH | Errors for servo amplifier, amplifier manufactured by other companies, and head module |
| Moderate errors | 3000H to 30FFH | Initial process errors |



# Error storage

When an error occurs, the error detection signal turns ON, and the error code corresponding to the error details is stored in "[Md.23] Axis error No.". Note that there is a delay of up to operation cycle after the error detection signal turns ON until the error code is stored.

When an alarm occurs on servo amplifier, the alarm No. displayed in LED of servo amplifier is stored in "[Md.114] Servo alarm". Check the error details and remedies with "[Md.114] Servo alarm".

| Axis No. | Error detection signal | Error code | Servo alarm |
|---|---|---|---|
| 1 | [Md.31] Status: b13 | [Md.23] Axis error No.*1 | [Md.114] Servo alarm |
| 2 | | | |
| 3 | | | |
| 4 | | | |
| 5 | | | |
| ⋮ | | | |
| 16 | | | |

*1 A new error code is stored in "[Md.23] Axis error No." every time an error occurs.

**Point**

When any error that is independent of an axis is detected, it is stored in the axis error No. of axis 1.
(These errors are stored in the axis error No. of axis 1 for the system which does not use the axis 1.)

For the synchronous encoder axis, "b4: Error detection flag" of "[Md.325] Synchronous encoder axis status" for target axis turns ON, and the input axis error number is stored in "[Md.326] Synchronous encoder axis error No.".

# Warning type

Warnings detected by the Simple Motion module include system warnings, axis warnings and warnings detected by servo amplifier.

## Simple Motion module detection system warnings

- System control data setting warnings: An axis warning for axis 1 will occur.
- Positioning data setting warnings: An axis warning for each axis will occur. Note that a warning will occur for the reference axis when an interpolation designation or axis setting warning occurs.

## Simple Motion module detection axis warnings

- Axis warnings that occur at operation start or during operation such as the positioning operation, JOG operation or manual pulse generator operation.
- Axis warnings that occur due to system warnings: The axis operation status does not change even though an axis warning occurs.

## Servo amplifier detection warnings

The warnings that occur when the hardware error of the servo amplifier or servo motor occurs or the servo parameter is inapplicable.

The servo may not be turned off depending on the warning. However, an error occurs or the operation cannot be executed normally if the warning is remained.

When the warning cause is removed, the warning is automatically released in the servo amplifier. However, the state that the warning occurs is continued in the Simple Motion module.

Reset it as necessary.

# Warning code classification

| Item | Warning code | Classification of warnings |
|---|---|---|
| Warnings | 0900H to 093FH | Positioning control common warnings |
| | 0980H to 098FH | JOG, inching and manual pulse generator operation warnings |
| | 0990H to 09EFH | Positioning operation warnings |
| | 09F0H to 09FFH | Block start data warnings |
| | 0A10H to 0A5FH | Positioning data warnings |
| | 0BA0H to 0BDFH | Synchronous control input axis warnings |
| | 0BE0H to 0C3FH | Synchronous control output axis warnings |
| | 0C40H to 0C7FH | Cam data operation warnings |
| | 0C80H to 0CBFH | Warnings for servo amplifier, amplifier manufactured by other companies, and head module |

# Warning storage

When an axis warning occurs, the warning code corresponding to the warning details is stored in "[Md.24] Axis warning No.".

When an axis warning occurs in a positioning operation, etc., axis warning detection ([Md.31] Status: b9) for axis status storage turns ON.

When a warning occurs on servo amplifier, the warning No. displayed in LED of servo amplifier is stored in "[Md.114] Servo alarm". Check the warning details and remedies with "[Md.114] Servo alarm".

| Warning detection signal | Warning code | Servo alarm |
|---|---|---|
| [Md.31] Status: b9 | [Md.24] Axis warning No.*1 | [Md.114] Servo alarm |

*1 A new warning code is stored in "[Md.24] Axis warning No." every time a warning occurs.

For the synchronous encoder axis, "b5: Warning detection flag" of "[Md.325] Synchronous encoder axis status" for target axis turns ON, and the input axis warning number is stored in "[Md.327] Synchronous encoder axis warning No.".

# Clearing errors and warnings

Remove the cause of error or warning following the actions described in the sections below before canceling an error or warning state by resetting the error.

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## How to clear errors or warnings

An error or warning state is canceled after the following processing is carried out by setting "1" in "[Cd.5] Axis error reset".

- Axis error detection signal is turned OFF.
- "[Md.23] Axis error No." is cleared.
- "[Md.24] Axis warning No." is cleared.
- "[Md.26] Axis operation status" is changed from "Error" to "Standby".
- "Axis warning detection ([Md.31] Status: b9)" is turned OFF.

**Point**

When servo amplifier errors cannot be reset even if error reset is requested, "0" is not stored in "[Cd.5] Axis error reset" by Simple Motion module. It remains "1". Set "0" in "[Cd.5] Axis error reset" and then set "1" to execute the error reset again by user side.

For the synchronous encoder axis, an error or warning state is canceled after the following processing is carried out by setting "1" in "[Cd.323] Synchronous encoder axis error reset" for target axis.

- "b4: Error detection flag" of "[Md.325] Synchronous encoder axis status" is turned OFF.
- "[Md.326] Synchronous encoder axis error No." is cleared.
- "b5: Warning detection flag" of "[Md.325] Synchronous encoder axis status" is turned OFF.
- "[Md.327] Synchronous encoder axis warning No." is cleared.

# 14.4 List of Warning Codes

## Simple Motion module detection warning

| Warning code (Hexadecimal) | Warning name | Error details and causes | Remedy |
|---|---|---|---|
| 0900H | Start during operation | • The start request is issued while the axis is BUSY.<br>• Positioning was started during speed control mode/ torque control mode.<br>[Operation status at warning occurrence]<br>Position control mode: The operation continues.<br>Speed control mode/torque control mode: The operation continues. (Positioning start is not executed.) | • Normalize the start request ON timing.<br>• When in speed control mode/torque control mode, start positioning after switching to the position control mode. |
| 0902H | Restart not possible | The restart command is issued when the axis operation status is not "Stopped".<br>[Operation status at warning occurrence]<br>Continues the operation. | Normalize the start request ON timing.<br>(Do not issue the restart command when the axis operation status is not stopped.) |
| 0903H | Teaching in BUSY | The teaching request is issued while the axis is BUSY.<br>[Operation status at warning occurrence]<br>The warning is issued for the axis designated at the time of the teaching request. | Carry out the teaching request when the axis is not BUSY. |
| 0904H | Less than minimum speed | The overridden speed becomes "0".<br>[Operation status at warning occurrence]<br>The system is controlled with the currently executing unit of 1. | Prevent the overridden speed from being reduced to 0. |
| 0905H | In PLC READY | The request for writing to the flash ROM is issued when the PLC READY is turned ON.<br>[Operation status at warning occurrence]<br>The warning for axis 1 is issued. | Request to write when the PLC READY signal [Y0] is OFF. |
| 0906H | Illegal override value | A value other than 0 to 300 is set for the override value.<br>[Operation status at warning occurrence]<br>When a setting value is 301 or more: Controlled at 300. | Set a value within the setting range. |
| 0907H | Outside new torque value range/outside forward new torque value range | A new torque value/forward new torque value exceeds the torque limit setting value.*1<br>[Operation status at warning occurrence]<br>The torque change is not carried out. | Set a new torque value/forward new torque value equal to or less than the torque limit setting value. |
| 0908H | Below bias speed | The command speed is below the bias speed at start.<br>[Operation status at warning occurrence]<br>Operates by the bias speed at start. | Re-set the command speed/bias speed at start so that the command speed is equal to or larger than the bias speed at start. |
| 0932H | Outside reverse new torque value range | A reverse new torque value exceeds the torque limit setting value.<br>[Operation status at warning occurrence]<br>The torque change is not carried out. | Set a value which does not exceed the torque limit setting value as the reverse new torque value. |
| 0933H | Optional data monitor data type setting error | In the optional data monitor, 2-word data is not set correctly.<br>[Operation status at warning occurrence]<br>Monitoring is not carried out. "0" is stored in [Md.109] to [Md.112] (Optional data monitor output 1 to 4). | Set the 2-word data to "[Pr.91] Optional data monitor: Data type setting 1" or "[Pr.93] Optional data monitor: Data type setting 3" and 0 to "[Pr.92] Optional data monitor: Data type setting 2" or "[Pr.94] Optional data monitor: Data type setting 4". |
| 0935H | VCⅡ series parameter setting error | The servo parameter "Absolute position detection system (PA03)" is different from VCⅡ series.<br>[Operation status at warning occurrence]<br>The operation is executed by the setting of VCⅡ series. | Match the setting of the servo parameter "Absolute position detection system (PA03)" to the setting of VCⅡ series, and turn the PLC READY signal [Y0] from OFF to ON. |
| 0936H | Outside mark detection signal setting range | The mark detection signal setting is outside the range.<br>[Operation status at warning occurrence]<br>The setting number of which the mark detection setting parameter is outside the range is invalid. | Set a value within the setting range. |
| 0937H | Outside mark detection data type setting range | The mark detection data type setting is outside the range.<br>[Operation status at warning occurrence]<br>The setting number of which the mark detection setting parameter is outside the range is invalid. | Set a value within the setting range. |

| Warning code (Hexadecimal) | Warning name | Error details and causes | Remedy |
|---|---|---|---|
| 0938H | Outside mark detection data axis No. setting range | When the mark detection data type setting is not "Optional 2 word buffer memory", the mark detection data type setting is outside the range.<br>[Operation status at warning occurrence]<br>The setting number of which the mark detection setting parameter is outside the range is invalid. | Set a value within the setting range. |
| 0939H | Outside mark detection data buffer memory No. setting range | When the mark detection data type setting is "Optional 2 word buffer memory", the mark detection data buffer memory No. is outside the range or odd number.<br>[Operation status at warning occurrence]<br>The setting number of which the mark detection setting parameter is outside the range is invalid. | Set a value with an even number within the setting range. |
| 093AH | Outside maximum number of control axes | The common parameter "[Pr.152] Maximum number of control axes" exceeds the number of control axes of Simple Motion module.<br>[Operation status at warning occurrence]<br>Controlled as "0: No setting". | Correct the setting value. |
| 093BH | Outside control axis setting | "[Pr.100] Connected device" is set to the axis that exceeded the "[Pr.152] Maximum number of control axes".<br>[Operation status at warning occurrence]<br>The communication with the connected device is not executed. | Correct the "[Pr.152] Maximum number of control axes" or "[Pr.100] Connected device". |
| 093CH | Home position return data incorrect | • The backup data for absolute position restoration is illegal.<br>• The home position return has never been executed after the system start.<br>• The home position return is started, but not completed correctly.<br>• "Absolute position erased" in the driver is detected.<br>• "Rotation direction selection (PA14)" of the servo parameter has been changed.<br>[Operation status at warning occurrence]<br>The operation continues. | Execute home position return. |
| 093EH | SSCNET communication error | Data received from servo amplifier is in error.<br>[Operation status at warning occurrence]<br>The operation continues. | • Check the SSCNETⅢ cable.<br>• Check the servomotor and encoder cable.<br>• Take measures against noise.<br>• Check whether the rotation direction selection/travel direction selection (PA14) is set "0 → 1" or "1 → 0" in the user program or the engineering tool. |
| 0980H | Speed change during deceleration | The speed change request is issued during deceleration stop with JOG start signal OFF.<br>[Operation status at warning occurrence]<br>The speed change is not carried out. | Do not carry out the JOG speed change during deceleration with the JOG start signal OFF. |
| 0981H | JOG speed limit value | The JOG speed[*2] exceeds the JOG speed limit value at start.<br>[Operation status at warning occurrence]<br>• When the speed exceeds the JOG speed limit, the JOG operation is carried out with the JOG speed limit value.<br>• While the speed is limited by the JOG speed limit value, the "[Md.39] In speed limit flag" is turned ON. | Set a value within the setting range. |
| 0982H | JOG speed limit value | The new speed value[*2] exceeds the JOG speed limit value when the speed is changed during operation.<br>[Operation status at warning occurrence]<br>• When the speed exceeds the JOG speed limit, the JOG operation is carried out with the JOG speed limit value.<br>• While the speed is limited by the JOG speed limit value, the "[Md.39] In speed limit flag" is turned ON. | Set a value within the setting range. |
| 0988H | Outside manual pulse generator input magnification range | The manual pulse generator 1 pulse input magnification is set to 0, 10001 or more, or negative value.<br>[Operation status at warning occurrence]<br>• When input magnification is set at 10001 or more, or negative value: Re-set to 10000.<br>• When input magnification is set at 0: Re-set to 1. | Set the manual pulse generator 1 pulse input magnification to within the setting range. |

| Warning code (Hexadecimal) | Warning name | Error details and causes | Remedy |
|---|---|---|---|
| 0989H | Outside manual pulse generator speed limit value | The manual pulse generator speed exceeds "[Pr.123] Manual pulse generator speed limit value".<br>[Operation status at warning occurrence]<br>• When the speed exceeds the detailed parameter 2 "Manual pulse generator speed limit value", the manual pulse generator operation is executed following the detailed parameter 2 "Manual pulse generator speed limit mode".<br>• "In speed limit flag" is turned ON while the speed is controlled with the detailed parameter 2 "Manual pulse generator speed limit value". | Adjust speed of manual pulse generator or "[Cd.20] Manual pulse generator 1 pulse input magnification" not to exceed the speed limit value. |
| 0990H | Deceleration/stop speed change | The speed change request is issued during deceleration stop.<br>[Operation status at warning occurrence]<br>The speed change is not carried out. | Do not carry out the speed change during deceleration with a stop command, during stoppage, or during automatic deceleration with position control. |
| 0991H | Speed limit value over | • Setting speeds[*2] exceed the speed limit value when starting/restarting the positioning or when changing the speed at the positioning[*3]. (At the interpolation control, either of reference axes or interpolation axes exceeds the speed limit value.)<br>• "[Cd.140] Command speed at speed control mode" exceeds "[Pr.8] Speed limit value" during the speed control mode.<br>• "[Cd.146] Speed limit value at torque control mode" exceeds "[Pr.8] Speed limit value" during the torque control mode.<br>• "[Cd.147] Speed limit value at continuous operation to torque control mode" exceeds "[Pr.8] Speed limit value" during the continuous operation to torque control mode.<br>[Operation status at warning occurrence]<br>[Position control mode]<br>• The speed is controlled with the speed limit value.<br>• The "[Md.39] In speed limit flag" is turned ON.<br>[Speed control mode/Torque control mode/Continuous operation to torque control]<br>• The speed is controlled with the speed limit value. (The "[Md.39] In speed limit flag" is not turned ON.) | Review each speed so that setting speeds do not exceed the speed limit value. |
| 0992H | M code ON signal ON | The M code ON signal is turned ON when the positioning data is executed.<br>[Operation status at warning occurrence]<br>Continues executing the positioning data. | Normalize the ON and OFF timings of the "M code OFF request". |
| 0993H | Speed-position switching (during acceleration) signal ON | The switching signal for speed-position switching control (INC mode) is turned ON during acceleration.<br>[Operation status at warning occurrence]<br>The operation is continued. | Do not turn ON the speed-position switching signal during acceleration. |
| 0994H | Insufficient remaining distance | At a continuous operation interrupt request, the distance required deceleration stop is not long enough.<br>[Operation status at warning occurrence]<br>• When a command speed is changed: Change to a value as near a new speed value as possible.<br>• When a target position is changed: Adjust the speed to a value as near the command speed as possible, and then change to a target position.<br>(When the operation pattern is a continuous path control, ignore the operations stated above.) | Give a request at the position where there is an enough remaining distance. |
| 0995H | Insufficient remaining distance | At a speed change request, the remaining distance is shorter than the distance required for speed change.<br>[Operation status at warning occurrence]<br>• When a command speed is changed: Change to a value as near a new speed value as possible.<br>• When a target position is changed: Adjust the speed to a value as near the command speed as possible, and then change to a target position.<br>(When the operation pattern is a continuous path control, ignore the operations stated above.) | Give a request at the position where there is an enough remaining distance. |

| Warning code (Hexadecimal) | Warning name | Error details and causes | Remedy |
|---|---|---|---|
| 0996H | Step not possible | Code 1 is set for the step start information when the step is outside standby.<br>[Operation status at warning occurrence]<br>The step will not start. | Do not set a "1" to the step start information when the step is not in standby state. |
| 0997H | Illegal external command function | The detailed parameter 2 "External command function selection" setting range is exceeded.<br>[Operation status at warning occurrence]<br>Even if the external command signal is turned ON, the system will not perform anything. | Set the detailed parameter 2 "External command function selection" to within the setting range. |
| 0998H | Insufficient movement amount | The movement amount is not large enough for automatic deceleration.<br>[Operation status at warning occurrence]<br>The system stops immediately after it reaches the positioning address. | Set a decelerating address or a movement amount to the positioning data. |
| 0999H | Illegal teaching data No. | The positioning data No. is set outside the setting range.<br>[Operation status at warning occurrence]<br>Teaching is not carried out when the setting value is 0 or 601 or more.<br>(The setting value is automatically reset to "0" by the Simple Motion module even when a "0" or "601" or more is set.) | Set the positioning data No. to within the setting range. |
| 099AH | Illegal teaching data selection | The teaching data selection set value is outside the setting range.<br>[Operation status at warning occurrence]<br>Teaching is not carried out. | Set the teaching data selection set value to within the setting range. |
| 099BH | Target position change not possible | • A target position change request was given for the control method other than ABS1 and INC1.<br>• A target position change request was given during speed control mode, torque control mode or continuous operation to torque control mode.<br>[Operation status at warning occurrence]<br>The target position change is not carried out. | Do not turn ON the target position change request in the following cases.<br>• A control method other than ABS1 and INC1 is used.<br>• During speed control mode |
| 099CH | Target position change not possible | A target position change request is turned ON during continuous path control.<br>[Operation status at warning occurrence]<br>The target position change is not carried out. | Do not turn ON the target position change request when an operating pattern "continuous path control" is used. |
| 099DH | Target position change not possible | A target position change request was given during deceleration to a stop.<br>[Operation status at warning occurrence]<br>The target position change is not carried out. | Do not turn ON the target position change request during deceleration stop. |
| 099EH | Target position change not possible | A target position change request was issued when speed change 0 flag ([Md.31] Status: b10) was ON.<br>[Operation status at warning occurrence]<br>The target position change is not carried out. | Do not turn ON the target position change request when speed change 0 flag ([Md.31] Status: b10) is ON. |
| 099FH | Target position change not possible | "[Cd.27] Target position change value (New address)" is outside the software stroke limit range (+).<br>[Operation status at warning occurrence]<br>The target position change is not carried out. | Correct the setting value. |
| 09A0H | Target position change not possible | "[Cd.27] Target position change value (New address)" is outside the software stroke limit range (-).<br>[Operation status at warning occurrence]<br>The target position change is not carried out. | Correct the setting value. |
| 09A1H | Target position change not possible | "[Cd.27] Target position change value (New address)" is out of range (0 to 359.99999 [degree]).<br>[Operation status at warning occurrence]<br>The target position change is not carried out. | Correct the setting value. |
| 09E4H | Torque limit value over | • A value exceeding "[Pr.17] Torque limit setting value" is set to "[Cd.143] Command torque at torque control mode" at torque control mode.<br>• A value exceeding "[Pr.17] Torque limit setting value" is set to "[Cd.150] Target torque at continuous operation to torque control mode" at continuous operation to torque control mode.<br>[Operation status at warning occurrence]<br>The torque is controlled with the torque limit setting value. | Review the setting value so that the setting torque is not exceeded the torque limit setting value. |

| Warning code (Hexadecimal) | Warning name | Error details and causes | Remedy |
|---|---|---|---|
| 09E5H | Torque initial value selection invalid | At switching the control mode, the servo parameter "Function selection C-B POL reflection selection at torque control (PC29)" is "0: Enabled" on the axis that set feedback torque into the torque initial value selection.<br>[Operation status at warning occurrence]<br>The initial value selection is controlled as the command torque. | • Use a servo amplifier which supports the servo parameter "Function selection C-B POL reflection selection at torque control (PC29)" and set (PC29) to "1: Disabled".<br>• At switching the control mode, set the torque initial value selection to command torque. |
| 09E6H | Control mode switching during BUSY | Control mode switching was executed from the position control mode to the speed control mode/torque control mode while BUSY was turned ON.<br>[Operation status at warning occurrence]<br>The control mode is not switched. (Positioning during operation continues.) | Switch the control mode after turning BUSY OFF. |
| 09E7H | Control mode switching during zero speed OFF | Control mode was changed when "Zero speed" ([Md.119] Servo status2) was turned OFF.<br>[Operation status at warning occurrence]<br>The control mode is not switched. (Current operation continues.) | Switch the control mode after turning "Zero speed" ([Md.119] Servo status2) ON. |
| 09E8H | Outside control mode range | Control mode switching request was performed by specifying a value outside the range for "[Cd.139] Control mode setting".<br>[Operation status at warning occurrence]<br>The control mode is not switched. (Current operation continues.) | Switch the control mode after setting a value within the range for "[Cd.139] Control mode setting". |
| 09E9H | Control mode switching | Control mode switching request was performed during the control mode switching.<br>[Operation status at warning occurrence]<br>Control mode switching request is not accepted. | Carry out the control mode switching request after completing the control mode switching. |
| 09EAH | Illegal control mode switching | • Switching to the speed/torque control mode is requested to the axis which does not support the control mode switching.<br>• Switching to the continuous operation to torque control mode is requested to the axis which does not support the control mode switching.<br>[Operation status at warning occurrence]<br>Control mode switching request is not accepted. | • Do not use the speed/torque control to the axis which does not support the control mode switching.<br>• Do not use the continuous operation to torque control to the axis which does not support the control mode switching. |
| 09EBH | Control mode switching not possible | • Control mode switching was performed from the position control mode to the continuous operation to torque control mode and then from the continuous operation to torque control mode to the speed control mode.<br>• Control mode switching was performed from the speed control mode to the continuous operation to torque control mode and then from the continuous operation to torque control mode to the position control mode.<br>• Control mode switching was performed between the torque control mode and continuous operation to torque control mode.<br>[Operation status at warning occurrence]<br>The control mode is not switched. (Current operation continues.) | Review so that control mode switching is performed between the position control mode and continuous operation to torque control mode or between the speed control mode and continuous operation to torque control mode. |
| 09F0H | No operation termination setting | In the positioning by block starting, the 50th point of the positioning start data is set to CONTINUE.<br>[Operation status at warning occurrence]<br>The operation is terminated. | Set the operation termination to the 50th point. |
| 09F1H | FOR to NEXT nest construction | FOR to NEXT is nested.<br>[Operation status at warning occurrence]<br>The operation is continued. | Make 1 nest construction for FOR to NEXT. |

| Warning code (Hexadecimal) | Warning name | Error details and causes | Remedy |
|---|---|---|---|
| 0A10H | Outside command speed range | • The speed change value is outside the setting range when changing the speed during operation*4<br>• "[Cd.140] Command speed at speed control mode" is outside the setting range during the speed control mode.<br>• "[Cd.146] Speed limit value at torque control mode" is outside the setting range during the torque control mode.<br>[Operation status at warning occurrence]<br>• The speed change value is controlled as the "maximum value within the setting range".<br>• The "[Md.39] In speed limit flag" is turned ON. | • Set the speed change value to within the setting range.<br>• Set "[Cd.140] Command speed at speed control mode" to within the setting range during the speed control mode.<br>• Set "[Cd.146] Speed limit value at torque control mode" to within the setting range during the torque control mode. |
| 0C80H | Driver warning | Warnings occur in the driver.<br>[Operation status at warning occurrence]<br>The operation continues. | Confirm the warning code by "[Md.114] Servo alarm" and refer to the driver instruction manual for details. |
| 0C81H | Incompatible device | Incompatible device is connected.<br>[Operation status at warning occurrence]<br>The operation continues. | Please contact with our sales representative. |
| 0CC0H | Inter-module synchronization cycle time over | The calculation process time of the inter-module synchronous interrupt (I44) exceeds the internal operation process time of the Simple Motion module.<br>[Operation status at warning occurrence]<br>The operation continues. | Set the operation time longer.<br>Review the number of steps of the inter-module synchronous interrupt (I44) to be short. |

*1 When the torque change function is used with the individual setting for new torque value and reverse new torque value, it indicates outside forward new torque value.

*2 This speed is a value in which override value is considered when override function is used. ("[Cd.13] Positioning operation speed override" is set other than 100 [%].)

*3 The speed change by position-speed switching control, target position change function, or override function is contained.

*4 The speed change by position-speed switching control or target position change function is contained.

Warnings related to synchronous control are described below.

| Warning code (Hexadecimal) | Warning name | Error details and causes | Remedy |
|---|---|---|---|
| 0BD0H | Input axis phase compensation amount over | Phase compensation amount of input axis is equal or lower than the minimum value (-2147483648), or exceeding the maximum value (2147483647).<br>[Operation status at warning occurrence]<br>The input axis operation continues. It is controlled with the minimum or maximum value. | • Set a smaller phase compensation advance time.<br>• Decrease the input axis speed. |
| 0BD1H | Input axis rotation direction restriction amount over | Rotation direction restriction amount of input axis is equal or lower than the minimum value (-2147483648), or exceeding the maximum value (2147483647).<br>[Operation status at warning occurrence]<br>The input axis operation continues. It is controlled with the minimum or maximum value. | • Confirm the enabled direction of the rotation direction restriction setting. (The setting may be reversed.)<br>• Check if the input axis moves to the reverse direction of the enabled direction. |
| 0BD2H | Input axis speed display over | Monitor speed display of input axis is equal or lower than the minimum value (-2147483648), or exceeding the maximum value (2147483647).<br>[Operation status at warning occurrence]<br>The input axis operation continues. The minimum or maximum value is displayed as the speed display of monitor data. | • Set a lower value if the number of decimal places for speed command setting is available in the input axis setting.<br>• Switch the units from minute to second if the speed command time unit setting is available in the input axis setting.<br>• Decrease the input axis speed. |
| 0BD3H | Synchronous encoder via servo amplifier battery warning | Voltage of the servo amplifier battery connected with a synchronous encoder decreased to 3.2 V or less.<br>[Operation status at warning occurrence]<br>The synchronous encoder control continues. | Replace the battery. |
| 0BE4H | Outside main shaft clutch control setting range | • The synchronous parameter "[Pr.405] Main shaft clutch control setting" was set to outside the setting range during the synchronous control.<br>• The synchronous parameter "[Pr.405] Main shaft clutch control setting" was set from a setting other than "No Clutch" to "No Clutch" during the synchronous control.<br>[Operation status at warning occurrence]<br>Synchronous control continues by the previous main shaft clutch control setting. | • Set a value within the range.<br>• Do not change the settings other than "No Clutch" to "No Clutch". |
| 0BF4H | Outside auxiliary shaft clutch control setting range | • The synchronous parameter "[Pr.422] Auxiliary shaft clutch control setting" was set to outside the setting range during the synchronous control.<br>• The synchronous parameter "[Pr.422] Auxiliary shaft clutch control setting" was set from a setting other than "No Clutch" to "No Clutch" during the synchronous control.<br>[Operation status at warning occurrence]<br>Synchronous control continues by the previous auxiliary shaft clutch control setting. | • Set a value within the range.<br>• Do not change the settings other than "No Clutch" to "No Clutch". |
| 0C01H | Outside speed change ratio denominator range | The synchronous parameter "[Pr.437] Speed change ratio: Denominator" is set to 0 or lower during synchronous control.<br>[Operation status at warning occurrence]<br>Synchronous control continues by the previous speed change ratio (Denominator). | Set a value within the range of 1 to 2147483647. |
| 0C10H | Outside cam No. range | The synchronous parameter "[Pr.440] Cam No." is set to other than 0 to 256 during synchronous control.<br>[Operation status at warning occurrence]<br>Synchronous control continues by the previous cam No. | Set a value within the range of 0 to 256. |
| 0C11H | Cam not registered | When changing the synchronous parameter "[Pr.440] Cam No.", the cam data of the changed cam No. does not exist on the Cam open area during synchronous control.<br>[Operation status at warning occurrence]<br>Synchronous control continues by the previous cam No. | Specify the cam No. of an existing cam data. |
| 0C14H | Cam axis phase compensation amount over | Phase compensation amount of cam axis is equal or lower than the minimum value (-2147483648), or exceeding the maximum value (2147483647).<br>[Operation status at warning occurrence]<br>Synchronous control continues. The operation is controlled with the minimum or maximum value. | • Set a smaller cam axis phase compensation advance time.<br>• Decrease the cam axis input value speed. |

| Warning code (Hexadecimal) | Warning name | Error details and causes | Remedy |
|---|---|---|---|
| 0C40H | Outside operation cam No. range | "[Cd.601] Operation cam No." is other than 1 to 256.<br>[Operation status at warning occurrence]<br>Cam data writing/reading is not executed. | Set a value within the range of 1 to 256. |
| 0C41H | Read cam not registered | Cam data of the specified cam No. does not exist on the cam open area during the cam data reading operation.<br>[Operation status at warning occurrence]<br>Cam data writing/reading is not executed. | • Specify the cam No. of an existing cam data.<br>• When writing the cam data from a programming tool, turn the PLC ready signal from OFF to ON and open the cam data on the cam open area. |
| 0C42H | Outside cam data first position range | • "[Cd.602] Cam data first position" is outside the range of "1 to Cam resolution" for the stroke ratio data format cam.<br>• "[Cd.602] Cam data first position" is outside the range of "0 to (Coordinate number - 1)" for the coordinate data format cam.<br>[Operation status at warning occurrence]<br>Cam data writing/reading is not executed. | • Set a value within the range of "1 to Cam resolution" for the stroke ratio data format cam.<br>• Set a value within the range of "0 to (Coordinate number - 1)" for the coordinate data format cam. |
| 0C43H | Outside number of cam data operation points range | • "[Cd.603] Number of cam data operation points" is outside the range of 1 to 4096 for the stroke ratio data format cam.<br>• "[Cd.603] Number of cam data operation points" is outside the range of 1 to 2048 for the coordinate data format cam.<br>• First position and number of operation points which exceed the cam resolution or coordinate number are set during the cam data writing operation.<br>[Operation status at warning occurrence]<br>Cam data writing/reading is not executed. | • Set a value within the range of 1 to 4096 for the stroke ratio data format cam.<br>• Set a value within the range of 1 to 2048 for the coordinate data format cam.<br>• Set "Cam data first position + (Number of cam data operation points - 1)" not to exceed the cam resolution.<br>• Set "Cam data first position + (Number of cam data operation points - 1)" not to exceed the number of coordinates. |
| 0C44H | Outside cam data format range | "[Cd.604] Cam data format" is other than 1 or 2 during the cam data writing operation.<br>[Operation status at warning occurrence]<br>Cam data writing/reading is not executed. | Set 1 or 2. |
| 0C45H | Outside cam resolution/coordinate number range | • "[Cd.605] Cam resolution/coordinate number" is other than "256/512/1024/2048/4096/8192/16384/ 32768" for the stroke ratio data format cam during the cam data writing operation.<br>• "[Cd.605] Cam resolution/coordinate number" is outside the range of "2 to 16384" for the coordinate data format cam during the cam data writing operation.<br>[Operation status at warning occurrence]<br>Cam data writing/reading is not executed. | • Set a value within the range of "256/512/1024/ 2048/ 4096/8192/16384/32768" for the stroke ratio data format cam.<br>• Set a value within the range of 2 to 16384 for the coordinate data format cam. |
| 0C46H | Outside cam data starting position range | "[Cd.606] Cam data starting point" is outside the range from "0 to (Cam resolution - 1)" during the cam data writing operation.<br>[Operation status at warning occurrence]<br>Cam data writing/reading is not executed. | Set a value within the range of "0 to (Cam resolution - 1)". |
| 0C47H | Cam storage area capacity over | • The free area in the cam storage area is insufficient during the cam data writing operation.<br>• The writable area is insufficient due to the decoupling of free area.<br>[Operation status at warning occurrence]<br>Cam data writing/reading is not executed. | • Decrease the number of cam data (number of cams, cam resolution, and coordinate number).<br>• Erase the cam data and rewrite it. |
| 0C48H | Cam open area capacity over | • The free area in the cam open area is insufficient during the cam data writing operation.<br>• The writable area is insufficient due to the decoupling of free area.<br>[Operation status at warning occurrence]<br>Cam data writing/reading is not executed. | • Decrease the number of cam data (number of cams, cam resolution, and coordinate number).<br>• Erase the cam data and rewrite it. |
| 0C49H | Coordinate data error | • Input value of coordinate data is a negative value during the cam data writing operation.<br>• Input value of coordinate data is not "$X_n < X_{n+1}$" during the cam data writing operation.<br>[Operation status at warning occurrence]<br>Cam data writing/reading is not executed. | • Set the Input value of coordinate data to 0 or more.<br>• Set the Input value of coordinate data to "$X_n < X_{n+1}$". |
| 0C4AH | Cam data reading operation inhibit | Cam data reading operation is executed with the cam data read password set.<br>[Operation status at warning occurrence]<br>Cam data writing/reading is not executed. | Delete the cam data read password with a programming tool. |

| Warning code (Hexadecimal) | Warning name | Error details and causes | Remedy |
|---|---|---|---|
| 0C4BH | Cam data writing operation inhibit | Cam data writing operation is executed with the cam data write password set.<br>[Operation status at warning occurrence]<br>Cam data writing/reading is not executed. | Delete the cam data write password with a programming tool. |
| 0C50H | Outside cam auto-generation cam No. range | "[Cd.609] Cam auto-generation cam No." is outside the range of 1 to 256.<br>[Operation status at warning occurrence]<br>Cam auto-generation is not executed. | Set a value within the range of 1 to 256. |
| 0C51H | Outside cam auto-generation type range | "[Cd.610] Cam auto-generation type" is other than 1.<br>[Operation status at warning occurrence]<br>Cam auto-generation is not executed. | Set 1. |
| 0C52H | Cam auto-generation cam storage area capacity over | • The free area in the cam storage area is insufficient.<br>• The writable area is insufficient due to the decoupling of free area.<br>[Operation status at warning occurrence]<br>Cam auto-generation is not executed. | • Decrease the number of cam data (number of cams, cam resolution, and coordinate number).<br>• Erase the cam data and rewrite it. |
| 0C53H | Cam auto-generation cam open area capacity over | • The free area in the cam open area is insufficient.<br>• The writable area is insufficient due to the decoupling of free area.<br>[Operation status at warning occurrence]<br>Cam auto-generation is not executed. | • Decrease the number of cam data (number of cams, cam resolution, and coordinate number).<br>• Erase the cam data and rewrite it. |
| 0C54H | Outside cam auto-generation data range | "[Cd.611] Cam auto-generation data" is outside the setting range.<br>[Operation status at warning occurrence]<br>Cam auto-generation is not executed. | Set a value within the setting range for the cam auto-generation. |
| 0C55H | Cam auto-generation calculation disable | "[Cd.611] Cam auto-generation data" is set to the value that the cam pattern cannot be generated. (Such as when the sheet synchronization width is larger than the sheet length in the cam for a rotary cutter)<br>[Operation status at warning occurrence]<br>Cam auto-generation is not executed. | Review the setting value of the cam auto-generation data. |
| 0C56H | Cam auto-generation data write inhibit | Cam auto-generation is executed with the cam data write password set.<br>[Operation status at warning occurrence]<br>Cam auto-generation is not executed. | Delete the cam data write password with a programming tool. |
| 0C60H | Outside cam position calculation cam No. range | "[Cd.613] Cam position calculation: Cam No." is outside the range of 0 to 256.<br>[Operation status at warning occurrence]<br>Cam position calculation is not executed. | Set a value within the range of 0 to 256. |
| 0C61H | Cam position calculation cam not registered | Cam data of the specified cam No. does not exist on the cam open area during the cam position calculation.<br>[Operation status at warning occurrence]<br>Cam position calculation is not executed. | • Specify the cam No. of an existing cam data.<br>• When writing the cam data from a peripheral software, turn the PLC ready signal from OFF to ON and open the cam data ON the cam open area. |
| 0C62H | Outside cam position calculation cam axis length per cycle range | "[Cd.615] Cam position calculation: Cam axis length per cycle" is set to 0 or lower.<br>[Operation status at warning occurrence]<br>Cam position calculation is not executed. | Set a value within the range of 1 to 2147483647. |
| 0C63H | Outside cam position calculation cam axis current value per cycle range | "[Cd.617] Cam position calculation: Cam axis current value per cycle" is outside the range of 0 to "Cam axis length per cycle".<br>[Operation status at warning occurrence]<br>Cam position calculation is not executed. | Set a value within the range of 0 to "Cam axis length per cycle". |
| 0C64H | Cam position calculation cam axis 1 cycle current value calculation disable | Corresponding cam axis current value per cycle could not be calculated during cam axis current value per cycle calculation. (Occurs in reciprocated cam pattern)<br>[Operation status at warning occurrence]<br>Cam position calculation is not executed. | Set "[Cd.614] Cam position calculation: Stroke amount", "[Cd.616] Cam position calculation: Cam reference position", and "[Cd.618] Cam position calculation: Cam axis feed current value" within the range of reciprocated cam pattern stroke. |

# Servo amplifier detection warning

For details of servo amplifier detection warnings, refer to each servo amplifier instruction manual.

# 14.5 List of Error Codes

## Simple Motion module detection error

| Error code (Hexadecimal) | Error name | Error details and causes | Remedy |
|---|---|---|---|
| 0000H | Normal | — | — |
| 1080H | Flash ROM write number error | Data is written to the flash ROM continuously 25 times or more from the program.<br>[Operation status at error occurrence]<br>The system does not write data to the flash ROM. | Review the program so that data is not written continuously to the flash ROM. (Using "[Md.19]", the number of flash ROM write times can be monitored.)<br>(If this error has occurred in a proper using method, writing is enabled by resetting the error, switching power OFF, then ON, or resetting the CPU module.) |
| 1867H | Dedicated instruction I/F error | Mismatching occurs between the CPU module and the Simple Motion module.<br>[Operation status at error occurrence]<br>At start: The system does not operate. | A trouble occurs. Repair. |
| 18B0H | Error when switching from normal operation mode to amplifier-less operation mode | Input signals other than synchronization flag [X1] are ON when switching from the normal operation mode to the amplifier-less operation mode.<br>[Operation status at error occurrence]<br>The operation mode is not changed. | Switch the operation mode after confirming that all input signals other than synchronization flag [X1] are OFF. |
| 18B1H | Error when switching from amplifier-less operation mode to normal operation mode | Input signals other than synchronization flag [X1] are ON when switching from the amplifier-less operation mode to the normal operation mode.<br>[Operation status at error occurrence]<br>The operation mode is not changed. | Switch the operation mode after confirming that all input signals other than synchronization flag [X1] are OFF. |
| 18C0H | Unit synchronization cycle setting unsupported | The setting value of unit synchronization cycle is unsupported.<br>[Operation status at error occurrence]<br>The READY signal [X0] is not turned ON. | With the setting brought into the supported range, switch the power on again or reset the CPU module. |
| 1900H | PLC READY OFF during operation | The PLC READY signal [Y0] is turned OFF during operation.<br>[Operation status at error occurrence]<br>The system stops with the setting (deceleration stop/ sudden stop) of the detailed parameter 2 Sudden stop selection (stop group 2).<br>(Note that the deceleration stop only occurs during the manual pulse generator operation.) | Review the program which turns ON/OFF PLC READY signal [Y0]. |
| 1902H | Servo READY signal OFF during operation | The servo READY signal is turned OFF during operation.<br>[Operation status at error occurrence]<br>During operation: The system stops immediately. | Check the servo amplifier power, wiring with the servo amplifier, and connection of connectors. |
| 1903H | Test mode faults during operation | The personal computer cannot communicate with the CPU module.<br>[Operation status at error occurrence]<br>The system stops with the setting (deceleration stop/ sudden stop) of the detailed parameter 2 Sudden stop selection (stop group 2).<br>(Note that the deceleration stop only occurs during the manual pulse generator operation.) | Check that there is no error on the personal computer side I/F to which a cable is connected. |
| 1904H | Hardware stroke limit (+) | Start is requested when the hardware stroke limit (upper limit signal FLS) is turned OFF.<br>[Operation status at error occurrence]<br>The system does not start. | • Check the wiring of upper limit signal FLS.<br>• Check if the specification of the limit switch and the setting of the "[Pr.22] Input signal logic selection" match.<br>• If hardware stroke limit (limit switch) is unnecessary system for installation, wire to always turn ON the upper limit signal (FLS) input of the Simple Motion module. |

| Error code (Hexadecimal) | Error name | Error details and causes | Remedy |
|---|---|---|---|
| 1905H | Hardware stroke limit (+) | The hardware stroke limit (upper limit signal FLS) is turned OFF during operation.<br>[Operation status at error occurrence]<br>The system stops with the setting (deceleration stop/ sudden stop) of the detailed parameter 2 Sudden stop selection (stop group 1).<br>(Note that the deceleration stop only occurs during the manual pulse generator operation.) | After making an axis error reset, perform manual control operation to move the axis to the other position in order that the upper limit signal (FLS) will not turn OFF. |
| 1906H | Hardware stroke limit (-) | Start is requested when the hardware stroke limit (lower limit signal RLS) is turned OFF.<br>[Operation status at error occurrence]<br>The system does not start. | • Check the wiring of lower limit signal RLS.<br>• Check if the specification of the limit switch and the setting of the "[Pr.22] Input signal logic selection" match.<br>• If hardware stroke limit (limit switch) is unnecessary system for installation, wire to always turn ON the lower limit signal (RLS) input of the Simple Motion module. |
| 1907H | Hardware stroke limit (-) | The hardware stroke limit (lower limit signal RLS) is turned OFF during operation.<br>[Operation status at error occurrence]<br>The system stops with the setting (deceleration stop/ sudden stop) of the detailed parameter 2 Sudden stop selection (stop group 1).<br>(Note that the deceleration stop only occurs during the manual pulse generator operation.) | After making an axis error reset, perform manual control operation to move the axis to the other position in order that the lower limit signal (RLS) will not turn OFF. |
| 1908H | Stop signal ON at start | Start is requested when a stop signal is turned ON.<br>[Operation status at error occurrence]<br>The system does not start. | After clearing the stop command status, then review the timing of start. |
| 1909H | Stop signal ON at start | Start is requested when an external stop is turned ON.<br>[Operation status at error occurrence]<br>The system does not start. | After clearing the external stop signal, then review the timing of start. |
| 190AH | READY OFF → ON during BUSY | The PLC READY signal is turned from OFF to ON when BUSY signal is turned ON.<br>[Operation status at error occurrence]<br>The READY signal [X0] is not turned ON. | Turn ON the PLC READY signal [Y0] with the BUSY signals of all axes OFF. |
| 190BH | Unsupported servo amplifier connection | A servo amplifier/driver which is not supported is connected.<br>[Operation status at error occurrence]<br>The target axis is not connected to the servo amplifier. | Connect supported servo amplifier/driver. |
| 1920H | Start not possible | Start is requested when start is not possible in the axis operation state.<br>[Operation status at error occurrence]<br>The system does not start positioning. | Do not request the start when the axis operation state is other than "0: Standby", "1: Stopped", and "-2: Step standby". |
| 1921H | Start not possible | Start is requested when the "[Md.26] Axis operation status" is "-1: Error".<br>[Operation status at error occurrence]<br>The system does not start positioning. | Do not request the start when the axis operation state is other than "0: Standby", "1: Stopped", and "-2: Step standby". |
| 1922H | Start not possible | Start is requested when the "[Md.26] Axis operation status" is "20: Servo amplifier has not been connected/ servo amplifier power OFF".<br>[Operation status at error occurrence]<br>The system does not start positioning. | Do not request the start when the axis operation state is other than "0: Standby", "1: Stopped", and "-2: Step standby". |
| 1923H | Start not possible | Start is requested when the "[Md.26] Axis operation status" is "21: Servo OFF".<br>[Operation status at error occurrence]<br>The system does not start positioning. | Do not request the start when the axis operation state is other than "0: Standby", "1: Stopped", and "-2: Step standby". |
| 1924H | Start not possible | Start is requested when communication with servo amplifier is error.<br>[Operation status at error occurrence]<br>The system does not start positioning. | Check the wiring with the servo amplifier and connection of connectors. |
| 1925H | Start not possible | Start is requested when the "[Md.26] Axis operation status" in the axis to be interpolated is "-1: Error", "20: Servo amplifier has not been connected/servo amplifier power OFF", and "21: Servo OFF".<br>[Operation status at error occurrence]<br>The system does not start positioning. | Do not request the start when the "[Md.26] Axis operation status" in the axis to be interpolated is other than "0: Standby", "1: Stopped", and "-2: Step standby". |

| Error code (Hexadecimal) | Error name | Error details and causes | Remedy |
|---|---|---|---|
| 1926H | Start not possible | Start is requested when "[Cd.100] Servo OFF command" is "1: Servo OFF".<br>[Operation status at error occurrence]<br>The system does not start positioning. | Set "0: Servo ON" in the "[Cd.100] Servo OFF command". |
| 1927H | Start not possible | Start is requested when the servo alarm occurs.<br>[Operation status at error occurrence]<br>The system does not start positioning. | Reset the error after removing the servo alarm referring to the "Servo Amplifier Instruction Manual". |
| 1928H | Start not possible | Start is requested during the forced stop of controller.<br>[Operation status at error occurrence]<br>The system does not start positioning. | Remove the cause of forced stop. |
| 1929H | Start not possible | Start is requested when the servo READY signal is turned OFF.<br>[Operation status at error occurrence]<br>The system does not start positioning. | Do not request the start when the servo READY signal is turned OFF. |
| 1930H | Hold error | In the CPU module parameter "Output at error stop", the setting for the Simple Motion module is "Hold".<br>[Operation status at error occurrence]<br>At start: The system does not operate.<br>During operation: The system stops with the setting (deceleration stop/sudden stop) of the detailed parameter 2 sudden stop selection (stop group 3). (Note that the deceleration stop only occurs during the manual pulse generator operation.) | Clear the setting of the CPU module parameter "Output at error stop". |
| 1931H | Flash ROM write error | Data is not written to the flash ROM.<br>[Operation status at error occurrence]<br>At start: The system does not operate. | The flash ROM is expected to be at the end of its writable life. |
| 1932H | Flash ROM sum check error | While data is written to the flash ROM, the power is turned OFF.<br>[Operation status at error occurrence]<br>At start: The system does not operate. | Reset the parameter and write it to a Flash ROM again. |
| 1933H | Flash ROM sum check error | While data is written to the flash ROM in the synchronous parameter area, the power is turned OFF.<br>[Operation status at error occurrence]<br>At start: The system does not operate. | Reset the parameter and write to the flash ROM again. |
| 1934H | Synchronous restoration data sum check error | Synchronous restoration data reading is failure.<br>[Operation status at error occurrence]<br>The synchronous control initial value cannot be restored. | The internal memory (nonvolatile) is expected to be at the end of its writable life. Exchange the module. |
| 193EH | Connected device setting error | The setting value (vendor ID, identification code) of the "[Pr.100] Connected device" and the actually connected device is mismatch.<br>[Operation status at error occurrence]<br>The communication between the connected devices or later of target axis is not executed. | Match the setting value of the "[Pr.100] Connected device" to the actually connected device. |
| 193FH | Operation cycle time over error | The calculation process time of the positioning etc. exceeds the operation cycle.<br>[Operation status at error occurrence]<br>The operation continues. | Review the content of the positioning or "[Pr.96] Operation cycle setting" longer than the current setting. |
| 1940H | Start at home position | • When the home position return retry invalid is set, the near-point dog method machine home position return is started with the home position return complete flag turned ON.<br>• Scale origin signal detection method machine home position return is started with the home position return complete flag turned ON and the near-point dog signal turned ON.<br>[Operation status at error occurrence]<br>The machine home position return does not start. | • Validate the home position return retry function (set value: 1).<br>• Move the work piece from the current position (on home position) using the manual control operation, then carry out a machine home position return again. |

| Error code (Hexadecimal) | Error name | Error details and causes | Remedy |
|---|---|---|---|
| 1941H | Dog detection timing fault | The near-point dog signal is turned OFF during the deceleration from a home position return speed to a creep speed by the near-point dog method machine home position return.<br>[Operation status at error occurrence]<br>The system stops with the setting (deceleration stop/ sudden stop) of the detailed parameter 2 Sudden stop selection (stop group 3). (Note that the deceleration stop only occurs during the manual pulse generator operation.) | • Lower the home position return speed.<br>• Increase the dog signal input time. |
| 1944H | Count method movement amount fault | In the count method 1 and 2 machine home position return, a parameter "Setting for the movement amount after near-point dog ON" is smaller than a distance necessary for deceleration stop from a home position return speed.<br>[Operation status at error occurrence]<br>At start: The system does not operate.<br>During operation: The system stops with the setting (deceleration stop/sudden stop) of the detailed parameter 2 Sudden stop selection (stop group 3). | • Calculate the movement distance using a speed limit, home position return speed, and deceleration time, and set the movement amount after near-point dog ON so that the distance becomes a deceleration distance or longer.<br>• Lower the home position return speed.<br>• Adjust the near-point dog position so that the movement amount after near-point dog ON becomes longer. |
| 1945H | Home position return request ON | The home position return request flag is turned ON when a fast-home position return is started (positioning start No. 9002).<br>[Operation status at error occurrence]<br>The fast-home position return does not start. | Execute the machine home position return (positioning start No. 9001). |
| 1946H | Home position return restart not possible | The restart command is turned ON after the machine home position return is stopped using a stop signal.<br>[Operation status at error occurrence]<br>The restart is not carried out. | Start the machine home position return (positioning start No. 9001) again. |
| 1974H | ZCT read error | The data is not loaded from the servo amplifier properly upon the home position return.<br>[Operation status at error occurrence]<br>The home position return does not complete. | • Execute home position return again.<br>• When the servo parameter "Function selection C-4 (PC17)" is changed to "1: Not need to pass servo motor Z-phase after power on", transfer the parameter from the Simple Motion module to the servo amplifier and turn the power supply of the servo amplifier OFF. Then, turn it ON and execute home position return again. |
| 1975H | ABS reference point read error | The data is not loaded from the servo amplifier properly upon the home position return.<br>[Operation status at error occurrence]<br>The home position return does not complete. | Execute home position return again. |
| 1977H | Encoder ABS data not established | Home position return is started on the direct drive motor when the absolute position data of the encoder has not been established.<br>[Operation status at error occurrence]<br>The home position return does not start. | Turn the power supplies of the system or servo amplifier from OFF to ON after passing the zero point of the motor by the JOG operation, etc. |
| 1978H | Z-phase passing parameter invalid | Servo amplifier parameter "Function selection C-4 (PC17)" is not set to "0: Need to pass servo motor Z-phase after power on" in the machine home position return of scale origin signal detection method.<br>[Operation status at error occurrence]<br>The home position return does not start. | Set "0: Need to pass servo motor Z-phase after power on" in the servo parameter "Function selection C-4 (PC17)". |
| 197AH | Home position return zero point not passed | The zero point is not passed when the dog method, count method or scale origin signal detection method home position return is re-started, or data set method home position return is executed.<br>[Operation status at error occurrence]<br>The home position return does not complete. | Turn the motor more than one revolution using JOG or positioning operation. |
| 1980H | Outside JOG speed range | At the time of JOG starting, the JOG speed comes out of a specified range.<br>[Operation status at error occurrence]<br>The JOG operation is not carried out when the JOG speed is outside the setting range at the time of JOG start. | Bring the JOG speed into the setting range. |

| Error code (Hexadecimal) | Error name | Error details and causes | Remedy |
|---|---|---|---|
| 1981H | Inching movement amount error | The inching movement amount dose not satisfy the setting conditions[*1]. (The setting value is large.)<br>[Operation status at error occurrence]<br>The inching operation is not carried out when the inching movement amount exceeds a JOG speed limit at the time of inching start. | Set a smaller inching movement amount so that the setting condition is satisfied. |
| 1982H | Overcarrying movement amount overflow in manual pulse generator | The movement amount which exceeds the detailed parameter 2 "Manual pulse generator speed limit value" is generated continuously and the "Amount of the manual pulser driving carrying over movement" exceeds tolerance (-2147483648 to 2147483647).<br>[Operation status at error occurrence]<br>The system decelerates to a stop. | • Adjust input pulses so as not to occur the movement amount, which exceeds the detailed parameter 2 "Manual pulse generator speed limit value", continuously.<br>• Change the detailed parameter 2 "Manual pulse generator speed limit mode" to a value other than "2: Output over value of speed limit later". |
| 1990H | Error before simultaneous start | <When multiple axes are started and controlled simultaneously><br>• The partner axis for simultaneous start is BUSY.<br>• The partner axis for simultaneous start is not present.<br>[Operation status at error occurrence]<br>At start: The system does not operate.<br>During operation: The operation is terminated. | Normalize the simultaneous start axis. |
| 1991H | Error before simultaneous start | <When multiple axes are started and controlled simultaneously><br>• The same axis number is set to multiple simultaneous start axes.<br>• The own axis number is set to a simultaneous start axis.<br>• The number of simultaneous start axes is outside the setting range of 2 to 4.<br>• The "Simultaneous starting axis start data No." of the start axis is 0 or is outside the setting range.<br>• The "Simultaneous starting axis start data No." of the start axis and the partner axis for simultaneous start is 0 or is outside the setting range.<br>[Operation status at error occurrence]<br>At start: The system does not operate.<br>During operation: The operation is terminated. | Normalize the simultaneous starting own axis start data No. and the simultaneous starting axis start data No.(1 to 3). |
| 1993H | Software stroke limit+ | The command position exceeds the upper limit of the software stroke limit.<br>[Operation status at error occurrence]<br>At operation start: The system does not operate.<br>During operation:<br>• The system stops immediately when the positioning address during position control (including position control in speed-position switching control or position-speed switching control) is switched to the data outside the software stroke limit range.<br>• During speed control (including speed control in speed-position switching control or position-speed switching control), the system stops at the setting (normal deceleration stop only) of sudden stop selection (stop group 3) in the detailed parameter 2 when the current feed value or machine feed value during manual control is outside the software stroke limit range.<br>At speed control mode/torque control mode/continuous operation to torque control mode: The system switches to the position control mode and stops immediately when the current feed value is outside the software stroke limit range. | At operation start: Set the current feed value within the software stroke limit by the manual control operation.<br>At speed control mode/torque control mode/continuous operation to torque control mode: Review the operation so that the current feed value does not exceed the software stroke limit. |
| 1994H | Software stroke limit+ | The new current value exceeds the upper limit of the software stroke limit.<br>[Operation status at error occurrence]<br>In the analysis of new current value: Current value is not changed. | Set the new current value within the software stroke limit. |

| Error code (Hexadecimal) | Error name | Error details and causes | Remedy |
|---|---|---|---|
| 1995H | Software stroke limit- | The command position exceeds the lower limit of the software stroke limit.<br>[Operation status at error occurrence]<br>At operation start: The system does not operate.<br>During operation:<br>• The system stops immediately when the positioning address during position control (including position control in speed-position switching control or position-speed switching control) is switched to the data outside the software stroke limit range.<br>• During speed control (including speed control in speed-position switching control or position-speed switching control), the system stops at the setting (normal deceleration stop only) of sudden stop selection (stop group 3) in the detailed parameter 2 when the current feed value or machine feed value during manual control is outside the software stroke limit range.<br>At speed control mode/torque control mode/continuous operation to torque control mode: The system switches to the position control mode and stops immediately when the current feed value is outside the software stroke limit range. | At operation start: Set the current feed value within the software stroke limit by the manual control operation.<br>At speed control mode/torque control mode/continuous operation to torque control mode: Review the operation so that the current feed value does not exceed the software stroke limit. |
| 1996H | Software stroke limit - | The new current value exceeds the lower limit of the software stroke limit.<br>[Operation status at error occurrence]<br>In the analysis of new current value: Current value is not changed. | Set the new current value within the software stroke limit. |
| 1997H | Outside new current value range | The new current address is outside the ranges of 0 to 359.99999, where the control unit is set to "degree".<br>[Operation status at error occurrence]<br>Current value is not changed. | Bring the new current value into the setting range. |
| 1998H | Interpolation while interpolation axis BUSY | Interpolation is started during the operation of the interpolation axis.<br>[Operation status at error occurrence]<br>At start: The system does not operate.<br>During operation: The system stops with the setting (deceleration stop/sudden stop) of the detailed parameter 2 Sudden stop selection (stop group 3).<br>(Note that the deceleration stop only occurs during the manual pulse generator operation.) | Correct the control method. |
| 1999H | Unit group unmatched | The reference and interpolation axis units are different at the parameter "interpolation speed designation method" setting of "composite speed".<br>[Operation status at error occurrence]<br>At start: The system does not operate.<br>During operation: The system stops with the setting (deceleration stop/sudden stop) of the detailed parameter 2 Sudden stop selection (stop group 3).<br>(Note that the deceleration stop only occurs during the manual pulse generator operation.) | Correct the positioning data or change the parameter "Unit setting" of the axis to be interpolated. |
| 199AH | Interpolation mode error | For starting, a composite speed is designated in the reference axis parameter "Interpolation speed designation method" using the speed interpolation control or 4-axis linear interpolation control.<br>[Operation status at error occurrence]<br>At start: The system does not operate.<br>During operation: The system stops with the setting (deceleration stop/sudden stop) of the detailed parameter 2 Sudden stop selection (stop group 3).<br>(Note that the deceleration stop only occurs during the manual pulse generator operation.) | Set the "Interpolation speed designation method" correctly. |

| Error code (Hexadecimal) | Error name | Error details and causes | Remedy |
|---|---|---|---|
| 199BH | Interpolation mode error | For starting, a reference axis speed is designated in the reference axis parameter "Interpolation speed designation method" using the circular interpolation control.<br>[Operation status at error occurrence]<br>At start: The system does not operate.<br>During operation: The system stops with the setting (deceleration stop/sudden stop) of the detailed parameter 2 sudden stop selection (stop group 3). (Note that the deceleration stop only occurs during the manual pulse generator operation.) | Set the "Interpolation speed designation method" correctly. |
| 199CH | Control method setting error | • The control method setting value is outside the setting range.<br>• The number of control axes or the axis to be interpolated differs from the previous data when continuous positioning control or continuous path control is to be exercised for continuously.<br>• The NOP instruction was set to the control method of positioning data No. 600.<br>[Operation status at error occurrence]<br>At start: The system does not operate.<br>During operation: The system stops with the setting (deceleration stop/sudden stop) of the detailed parameter 2 Sudden stop selection (stop group 3). (Note that the deceleration stop only occurs during the manual pulse generator operation.) | Correct the control method, axis to be interpolated or parameter. |
| 199EH | Simultaneous start not possible | Among the axes to be started simultaneously, there is an axis on which an error other than this error occurs.<br>[Operation status at error occurrence]<br>At start: The system does not operate.<br>During operation: The system stops with the setting (deceleration stop/sudden stop) of the detailed parameter 2 sudden stop selection (stop group 3). (Note that the deceleration stop only occurs during the manual pulse generator operation.) | In the error history, check the axis where the error other than this error occurred, and remove the error factor. Correct the block start data and positioning data. |
| 199FH | Circular interpolation not possible | Circular interpolation is carried out on an axis in the unit of degree.<br>[Operation status at error occurrence]<br>The operation is terminated. | Correct the control method. |
| 19A0H | M code ON signal start | The positioning start is carried out when an M code ON signal is turned ON.<br>[Operation status at error occurrence]<br>The system does not operate at start. | After turning OFF the M code ON signal, start the system. |
| 19A1H | PLC READY OFF start | The positioning start is carried out when the PLC READY signal [Y0] is turned OFF.<br>[Operation status at error occurrence]<br>The system does not operate at start. | Check the program which turns ON/OFF the PLC READY signal [Y0], and turn ON the PLC READY signal. Then start the system. |
| 19A2H | READY OFF start | The positioning start is carried out when the READY signal [X0] is turned OFF.<br>[Operation status at error occurrence]<br>The system does not operate at start. | Check the READY ON signal, and then start the system. |
| 19A3H | Outside start No. range | • At the start of positioning, the setting value of the "positioning start No." of the axis control data is outside the ranges of 1 to 600, 7000 to 7004, and 9001 to 9004.<br>• At a Pre-reading start, the "positioning start No." setting of the axis control data is other than 1 to 600.<br>[Operation status at error occurrence]<br>The system does not operate at start. | Normalize the positioning start No. |

| Error code (Hexadecimal) | Error name | Error details and causes | Remedy |
|---|---|---|---|
| 19A4H | Illegal setting of ABS direction in unit of degree | The setting value of the "[Cd.40] ABS direction in degrees" is outside the setting range when the software stroke limit is invalid.<br>[Operation status at error occurrence]<br>At start: The system does not operate.<br>During operation: The system decelerates to a stop. (Note that, in the continuous positioning control and continuous path control, the system continues operating with the setting set at the time of start even if the setting is changed during the operation.) | Correct the "[Cd.40] ABS direction in degrees". |
| 19A5H | Illegal setting of ABS direction in unit of degree | The setting value of the "[Cd.40] ABS direction in degrees" is set other than "0" when the software stroke limit is valid.<br>[Operation status at error occurrence]<br>At start: The system does not operate.<br>During operation: The system decelerates to a stop. (Note that, in the continuous positioning control and continuous path control, the system continues operating with the setting set at the time of start even if the setting is changed during the operation.) | • Set "0" when the software stroke limits are valid.<br>• Invalidate the software stroke limit. (To invalidate, set the software stroke limit upper limit value to the software stroke limit lower limit value.) |
| 19A6H | Start at home position return incomplete | • When executing operation setting at home position return incomplete, positioning was started at home position return request ON.<br>• When executing operation setting at home position return incomplete, control mode switching was executed at home position return request ON.<br>[Operation status at error occurrence]<br>At start: The system does not operate.<br>At control mode switching: The mode is not changed. | • Start after the home position return is executed.<br>• Switch the control mode after the home position return is executed.<br>• For systems which can operate the positioning control and speed-torque control though the home position return request is ON, set "1" to the setting value of the operation setting at home position return incomplete. |
| 19E4H | Outside control mode auto-shift switching parameter range | When setting the control mode auto-shift switching selection, the control mode auto-shift switching parameter is outside the range.<br>[Operation status at error occurrence]<br>During positioning control: The system stops with the setting of the detailed parameter 2 sudden stop selection (stop group 3).<br>During speed control mode: The mode is switched to position control mode, and the system stops immediately. | Set the control mode auto-shift switching parameter within the range and switch to the continuous operation to torque control mode. |
| 19E7H | Continuous operation to torque control not supported | Switching to the continuous operation to torque control mode is requested to a servo amplifier which does not support the continuous operation to torque control.<br>[Operation status at error occurrence]<br>During positioning control: The system stops with the setting of the detailed parameter 2 sudden stop selection (stop group 3).<br>During speed control mode: The mode is switched to position control mode, and the system stops immediately. | Use a servo amplifier which supports the continuous operation to torque control. |
| 19F0H | Illegal condition data No. | The condition data No. is outside the setting range when a block using the condition data is started by a special starting (conditional start, wait start, simultaneous start, FOR (condition)).<br>(1 ≤ Condition data No. ≤ 10)<br>[Operation status at error occurrence]<br>The operation is terminated. | Review the condition data No. |
| 19F1H | Error before simultaneous start | <When blocks are started simultaneously><br>The partner axis for simultaneous start is BUSY.<br>[Operation status at error occurrence]<br>At start: The system does not operate.<br>During operation: The operation is terminated. | Normalize the simultaneous start axis. |
| 19F2H | Special start instruction error | No applicable special start instruction is present.<br>[Operation status at error occurrence]<br>The operation is terminated. | Correct the instruction code of the special start. |

| Error code (Hexadecimal) | Error name | Error details and causes | Remedy |
|---|---|---|---|
| 1A00H | Condition data error | The condition setting values are not set or outside the setting range.<br>[Operation status at error occurrence]<br>The operation is terminated. | Normalize the block start data. |
| 1A01H | Condition data error | The condition operator setting values are not set or outside the setting range.<br>[Operation status at error occurrence]<br>The operation is terminated. | Normalize the block start data. |
| 1A02H | Condition data error | The condition operator is a bit operator, and the parameter 1 is 32 or more.<br>[Operation status at error occurrence]<br>The operation is terminated. | Normalize the block start data. |
| 1A03H | Condition data error | An unusable condition operator is set for the set condition.<br>[Operation status at error occurrence]<br>The operation is terminated. | Normalize the block start data. |
| 1A04H | Condition data error | • The conditional operator has been [parameter 1 is greater than parameter 2] with 05H (P1 ≤ ** ≤ P2).<br>• The conditional operator has been [parameter 1 is greater than parameter 2] with 06H (** ≤ P1, P2 ≤ **).<br>[Operation status at error occurrence]<br>The operation is terminated. | Normalize the block start data. |
| 1A05H | Condition data error | The setting value of "address" is outside the setting range when the condition target is set to "Buffer memory (1-word/2-word)". (1-word: 0 to 98303, 2-word: 0 to 98302)<br>[Operation status at error occurrence]<br>The operation is terminated. | Normalize the block start data. |
| 1A0CH | Condition data error | The same axis number is set in "[Da.24] Simultaneously starting axis No.1", [Da.25] Simultaneously starting axis No.2" and [Da.26] Simultaneously starting axis No.3".<br>[Operation status at error occurrence]<br>The operation is terminated. | Normalize the block start data. |
| 1A0DH | Condition data error | The axis number is set in "[Da.24] Simultaneously starting axis No.1", [Da.25] Simultaneously starting axis No.2" and [Da.26] Simultaneously starting axis No.3", that is larger than the common parameter "[Pr.152] Maximum number of control axes".<br>[Operation status at error occurrence]<br>The operation is terminated. | Normalize the block start data. |
| 1A0EH | Condition data error | The self axis is set in "[Da.24] Simultaneously starting axis No.1", [Da.25] Simultaneously starting axis No.2" and [Da.26] Simultaneously starting axis No.3".<br>[Operation status at error occurrence]<br>The operation is terminated. | Normalize the block start data. |
| 1A0FH | Condition data error | The "[Da.23] Number of simultaneously starting axes" is outside the setting range, or the "[Da.23] Number of simultaneously starting axes" is larger than the "[Pr.152] Maximum number of control axes".<br>[Operation status at error occurrence]<br>The operation is terminated. | Normalize the block start data. |
| 1A10H | Illegal data No. | The designation of a JUMP destination is executed currently.<br>[Operation status at error occurrence]<br>The positioning data is not executed. | Normalize the positioning data. |
| 1A11H | Illegal data No. | • The positioning data No. tried to be executed is outside the ranges of 1 to 600, 7000 to 7004, and 9001 to 9004.<br>• The designation of a JUMP destination is outside the ranges of 1 to 600.<br>[Operation status at error occurrence]<br>The positioning data is not executed. | Normalize the positioning data. |

| Error code (Hexadecimal) | Error name | Error details and causes | Remedy |
|---|---|---|---|
| 1A12H | No command speed | At the start of positioning, a current speed (-1) is set for the command speed of the positioning data to be initially executed.<br>[Operation status at error occurrence]<br>The operation does not start at positioning start. | Normalize the positioning data. |
| 1A13H | No command speed | The current speed is set by speed control.<br>[Operation status at error occurrence]<br>The operation does not start at positioning start. | Normalize the positioning data. |
| 1A14H | No command speed | The current speed is set for speed-position or position-speed switching control.<br>[Operation status at error occurrence]<br>The operation does not start at positioning start. | Normalize the positioning data. |
| 1A15H | Outside linear movement amount range | When "[Pr.20] Interpolation speed designation method" performs a linear interpolation in setting a "composite speed", the axis movement amount for each positioning data exceeds 1073741824($2^{30}$).<br>[Operation status at error occurrence]<br>At start: The system does not operate.<br>During operation: The system stops immediately. | Review the positioning address. |
| 1A16H | Outside linear movement amount range | The positioning address is -360.00000 or less or 360.00000 or more using INC instruction, where the control unit is set to "degree" and "[Pr.12] Software stroke limit upper limit value" is not equal to "[Pr.13] Software stroke limit lower limit value".<br>[Operation status at error occurrence]<br>At start: The system does not operate.<br>During operation: The system stops immediately. | Review the positioning address. |
| 1A17H | Large arc error deviation | When an arc is interpolated by the designation of the center point, a difference between a radius of start point—center point and a radius of end point—center point exceeds the parameter "Circular interpolation error allowable limit".<br>[Operation status at error occurrence]<br>At start: The circular interpolation control by center point designation is not executed.<br>During operation: The system stops immediately. | • Correct the center point address (arc address)<br>• Correct the end address (positioning address)<br>• Correct the circular interpolation error allowable limit value. |
| 1A18H | Software stroke limit + | The setting value of the "[Da.6] Positioning address/movement amount" exceeds "[Pr.12] Software stroke limit upper limit value".<br>[Operation status at error occurrence]<br>At operation start: The system does not operate.<br>In the analysis of new current value: Current value is not changed.<br>During operation:<br>• The system stops immediately when the positioning address during position control (including position control in speed-position switching control or position-speed switching control) is switched to the data outside the software stroke limit range.<br>• During speed control (including speed control in speed-position switching control or position-speed switching control), the system stops at the setting (normal deceleration stop only) of sudden stop selection (stop group 3) in the detailed parameter 2 when the current feed value or machine feed value during manual control is outside the software stroke limit range.<br>At speed control mode/torque control mode/continuous operation to torque control mode: The system switches to the position control mode and stops immediately when the current feed value is outside the software stroke limit range. | At operation start, during operation: Correct the "[Da.6] Positioning address/movement amount".<br>At operation start: Set the current feed value within the software stroke limit by the manual control operation. |
| 1A19H | Software stroke limit + | In the circular interpolation with sub points designated, the sub point exceeds "[Pr.12] Software stroke limit upper limit value".<br>[Operation status at error occurrence]<br>At operation start: The system does not start. | At operation start, during operation: Correct the "[Da.6] Positioning address/movement amount" and the "[Da.7] Arc address".<br>At operation start: Set the current feed value within the software stroke limit by the manual control operation. |

| Error code (Hexadecimal) | Error name | Error details and causes | Remedy |
|---|---|---|---|
| 1A1AH | Software stroke limit<br>- | The setting value of the "[Da.6] Positioning address/ movement amount" exceeds "[Pr.13] Software stroke limit lower limit value".<br>[Operation status at error occurrence]<br>At operation start: The system does not operate.<br>In the analysis of new current value: Current value is not changed.<br>During operation:<br>• The system stops immediately when the positioning address during position control (including position control in speed-position switching control or position-speed switching control) is switched to the data outside the software stroke limit range.<br>• During speed control (including speed control in speed-position switching control or position-speed switching control), the system stops at the setting (normal deceleration stop only) of sudden stop selection (stop group 3) in the detailed parameter 2 when the current feed value or machine feed value during manual control is outside the software stroke limit range.<br>At speed control mode/torque control mode/continuous operation to torque control mode: The system switches to the position control mode and stops immediately when the current feed value is outside the software stroke limit range. | At operation start, during operation: Correct the "[Da.6] Positioning address/movement amount".<br>At operation start: Set the current feed value within the software stroke limit by the manual control operation. |
| 1A1BH | Software stroke limit<br>- | In the circular interpolation with sub points designated, the sub point exceeds "[Pr.13] Software stroke limit lower limit value".<br>[Operation status at error occurrence]<br>At operation start: The system does not start. | At operation start, during operation: Correct the "[Da.6] Positioning address/movement amount" and the "[Da.7] Arc address".<br>At operation start: Set the current feed value within the software stroke limit by the manual control operation. |
| 1A1CH | New current value not possible | The control method sets an operation pattern (continuous path control) using new current positioning data.<br>[Operation status at error occurrence]<br>Current value is not changed. | • Do not designate a current value changing using the positioning data following the continuous path control.<br>• Do not designate positioning data following continuous path control using a "current value changing". |
| 1A1DH | New current value not possible | The operation pattern sets a "new current value" in the control method using the data following the "continuous path control" positioning data.<br>[Operation status at error occurrence]<br>Current value is not changed. | • Do not designate a current value changing using the positioning data following the continuous path control.<br>• Do not designate positioning data following continuous path control using a "current value changing". |
| 1A1EH | Continuous path control not possible | "[Da.1] Operation pattern" is "Continuous positioning control" or "Continuous path control" when "[Da.2] Control method" is "Speed control" or "Position-speed switching control".<br>[Operation status at error occurrence]<br>The system does not operate at start. | Correct the "[Da.1] Operation pattern" or "[Da.2] Control method". |
| 1A1FH | Continuous path control not possible | "[Da.1] Operation pattern" is "Continuous path control" when "[Da.2] Control method" is "Fixed-feed" or "Speed-position switching control".<br>[Operation status at error occurrence]<br>The system does not operate at start. | Correct the "[Da.1] Operation pattern" or "[Da.2] Control method". |
| 1A20H | Continuous path control not possible | "[Da.1] Operation pattern" is "Continuous path control" when "[Da.2] Control method" is "Speed control", "Fixed-feed", "Position-speed switching control" or "Speed-position switching control".<br>[Operation status at error occurrence]<br>The system does not operate at start. | Correct the "[Da.1] Operation pattern" or "[Da.2] Control method". |
| 1A21H | Outside operation pattern range | The operation pattern set value is 2.<br>[Operation status at error occurrence]<br>At start: The system does not operate.<br>During operation: The system stops with the setting (deceleration stop/sudden stop) of the detailed parameter 2 Sudden stop selection (stop group 3).<br>(Note that the deceleration stop only occurs during the manual pulse generator operation.) | Correct the operation pattern. |

| Error code (Hexadecimal) | Error name | Error details and causes | Remedy |
|---|---|---|---|
| 1A22H | Illegal interpolation description command | In the interpolation control, the axis to be interpolated is set as follows:<br>• The self axis<br>• Not present axis<br>• The axis number exceeds the maximum number of control axes.<br>[Operation status at error occurrence]<br>At start: The system does not operate.<br>During operation: The system stops with the setting (deceleration stop/sudden stop) of the detailed parameter 2 Sudden stop selection (stop group 3).<br>(Note that the deceleration stop only occurs during the manual pulse generator operation.) | • Correct the "[Da.2] Control method".<br>• Correct the axis to be interpolated.<br>• Correct the maximum number of control axes. |
| 1A23H | Command speed setting error | The command speed is outside the setting range.<br>Linear interpolation, circular interpolation: Reference axis is outside the setting range.<br>Speed control interpolation: Either of reference axis and interpolation axis is outside the speed range.<br>[Operation status at error occurrence]<br>At start: The system does not operate.<br>During operation: The system stops with the setting (deceleration stop/sudden stop) of the detailed parameter 2 Sudden stop selection (stop group 3).<br>(Note that the deceleration stop only occurs during the manual pulse generator operation.) | Correct the command speed. |
| 1A24H | Control method setting error | The control method setting value is outside the setting range.<br>[Operation status at error occurrence]<br>At start: The system does not operate.<br>During operation: The system stops with the setting (deceleration stop/sudden stop) of the detailed parameter 2 Sudden stop selection (stop group 3).<br>(Note that the deceleration stop only occurs during the manual pulse generator operation.) | Correct the control method, axis to be interpolated or parameter. |
| 1A25H | Control method setting error | The number of control axes or the axis to be interpolated differs from the previous data when continuous positioning control or continuous path control is to be exercised for continuously.<br>[Operation status at error occurrence]<br>At start: The system does not operate.<br>During operation: The system stops with the setting (deceleration stop/sudden stop) of the detailed parameter 2 Sudden stop selection (stop group 3).<br>(Note that the deceleration stop only occurs during the manual pulse generator operation.) | Correct the control method, axis to be interpolated or parameter. |
| 1A26H | Control method setting error | The NOP instruction was set to the control method of positioning data No.600.<br>[Operation status at error occurrence]<br>At start: The system does not operate.<br>During operation: The system stops with the setting (deceleration stop/sudden stop) of the detailed parameter 2 Sudden stop selection (stop group 3).<br>(Note that the deceleration stop only occurs during the manual pulse generator operation.) | Correct the control method, axis to be interpolated or parameter. |
| 1A27H | Sub point setting error | Start point is equal to sub point in the circular interpolation with sub points designated.<br>[Operation status at error occurrence]<br>At start: The system does not operate.<br>During operation: The system stops immediately. | Correct the sub address (arc address). |
| 1A28H | Sub point setting error | End point is equal to sub point in the circular interpolation with sub points designated.<br>[Operation status at error occurrence]<br>At start: The system does not operate.<br>During operation: The system stops immediately. | Correct the sub address (arc address). |

| Error code (Hexadecimal) | Error name | Error details and causes | Remedy |
|---|---|---|---|
| 1A29H | Sub point setting error | Start point, end point, and sub point are in line with each other in the circular interpolation with sub points designated.<br>[Operation status at error occurrence]<br>At start: The system does not operate.<br>During operation: The system stops immediately. | Correct the sub address (arc address). |
| 1A2AH | Sub point setting error | Sub point address is outside the range of -2147483648 to 2147483647 in the circular interpolation with sub points designated.<br>[Operation status at error occurrence]<br>At start: The system does not operate.<br>During operation: The system stops immediately. | Correct the sub address (arc address). |
| 1A2BH | End point setting error | Start point is equal to end point in the circular interpolation with sub points designated.<br>[Operation status at error occurrence]<br>At start: The system does not operate.<br>During operation: The system stops immediately. | Correct the end address (positioning address). |
| 1A2CH | End point setting error | End point address is outside the range of -2147483648 to 2147483647 in the circular interpolation with auxiliary point designation and center point designation.<br>[Operation status at error occurrence]<br>At start: The system does not operate.<br>During operation: The system stops immediately. | Correct the end address (positioning address). |
| 1A2DH | Center point setting error | Start point is equal to center point in the circular interpolation with center point designation.<br>[Operation status at error occurrence]<br>At start: The system does not operate.<br>During operation: The system stops immediately. | Correct the center point address (arc address). |
| 1A2EH | Center point setting error | End point is equal to center point in the circular interpolation with center point designation.<br>[Operation status at error occurrence]<br>At start: The system does not operate.<br>During operation: The system stops immediately. | Correct the center point address (arc address). |
| 1A2FH | Center point setting error | Center point address is outside the range of -2147483648 to 2147483647 in the circular interpolation with center point designation.<br>[Operation status at error occurrence]<br>At start: The system does not operate.<br>During operation: The system stops immediately. | Correct the center point address (arc address). |
| 1A30H | Outside address range | In the speed-position switching control and the position-speed switching control, the setting value of a positioning address is negative.<br>[Operation status at error occurrence]<br>At start: The system does not operate.<br>During operation: The system stops with the setting (deceleration stop/sudden stop) of the detailed parameter 2 sudden stop selection (stop group 3). (Note that the deceleration stop only occurs during the manual pulse generator operation.) | Correct the positioning address. |
| 1A31H | Outside address range | In ABS1, ABS2, ABS3 and ABS4, the setting value of a positioning address is outside the range of 0 to 359.99999 degrees.<br>[Operation status at error occurrence]<br>At start: The system does not operate.<br>During operation: The system stops with the setting (deceleration stop/sudden stop) of the detailed parameter 2 sudden stop selection (stop group 3). (Note that the deceleration stop only occurs during the manual pulse generator operation.) | Correct the positioning address. |
| 1A32H | Outside radius range | The arc radius exceeds 536870912.<br>[Operation status at error occurrence]<br>At start: The system does not operate.<br>During operation: The system stops immediately. | Correct the positioning data. |
| 1A33H | Control method LOOP setting error | A "0" is set in the repeating times of the control method "LOOP".<br>[Operation status at error occurrence]<br>The operation is terminated. | Set 1 to 65535 in the repeating time of LOOP. |

| Error code (Hexadecimal) | Error name | Error details and causes | Remedy |
|---|---|---|---|
| 1A34H | M code ON timing error | The setting value of the positioning data "[Da.27] M code ON signal output timing" is outside the setting range.<br>[Operation status at error occurrence]<br>At start: The system does not operate.<br>During operation: The system stops with the setting (deceleration stop/sudden stop) of the detailed parameter 2 sudden stop selection (stop group 3). | Correct the setting range of the "[Da.27] M code ON signal output timing" within "0 to 2". |
| 1A35H | Interpolation speed designation method error | The setting value of the positioning data "[Da.29] Interpolation speed designation method" is outside the setting range.<br>[Operation status at error occurrence]<br>At start: The system does not operate.<br>During operation: The system stops with the setting (deceleration stop/sudden stop) of the detailed parameter 2 sudden stop selection (stop group 3). | Correct the setting range of the "[Da.29] Interpolation speed designation method" within "0 to 2". |
| 1A36H | Outside number of pitch | The number of pitches set in "[Da.10] M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches" of the linear axis is outside the setting range when the helical interpolation control has been performed.<br>[Operation status at error occurrence]<br>At start: The system does not operate.<br>During operation: The system stops with the setting (deceleration stop/sudden stop) of the detailed parameter 2 sudden stop selection (stop group 3). | Correct the number of pitches set in "[Da.10] M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches" of the linear axis within "0 to 999". |
| 1A37H | Sub point setting error | The sub point address is outside the range of -2147483648 to 2147483647 when the circular interpolation control or helical interpolation control has been performed with the sub point being specified.<br>[Operation status at error occurrence]<br>At start: The system does not operate.<br>During operation: The system stops immediately. | Correct the sub address (arc address). |
| 1A60H | Outside unit setting range | The set value of the basic parameter 1 "Unit setting" is outside the setting range.<br>[Operation status at error occurrence]<br>The READY signal [X0] is not turned ON. | With the setting brought into the setting range, turn the PLC READY signal [Y0] from OFF to ON. |
| 1A61H | Outside pulse number per rotation range | The set value of the basic parameter 1 "Number of pulses per rotation" is outside the setting range.<br>[Operation status at error occurrence]<br>The READY signal [X0] is not turned ON. | With the setting brought into the setting range, turn the PLC READY signal [Y0] from OFF to ON. |
| 1A62H | Outside movement amount per rotation range | The set value of the basic parameter 1 "Movement amount per rotation" is outside the setting range.<br>[Operation status at error occurrence]<br>The READY signal [X0] is not turned ON. | With the setting brought into the setting range, turn the PLC READY signal [Y0] from OFF to ON. |
| 1A63H | Outside unit magnification range | • The set value of the basic parameter 1 "Unit magnification" is outside the setting range.<br>• "Movement amount per rotation (AL)" × "Unit magnification (AM)" exceeds 2147483648.<br>[Operation status at error occurrence]<br>The READY signal [X0] is not turned ON. | • Set AL and AM values which make "Movement amount per rotation (AL)" × "Unit magnification (AM)" within 2147483647, and then turn the PLC READY signal [Y0] from OFF to ON.<br>• With the setting brought into the setting range, turn the PLC READY signal [Y0] from OFF to ON. |
| 1A66H | Outside bias speed range | The setting value of the basic parameter 1 "Bias speed at start" is outside the setting range.<br>[Operation status at error occurrence]<br>The READY signal [X0] is not turned ON. | Correct the setting value and turn the PLC READY signal [Y0] from OFF to ON. |
| 1A67H | Outside bias speed range | The bias speed exceeds the speed limit value.<br>[Operation status at error occurrence]<br>The READY signal [X0] is not turned ON. | Set the bias speed equal to or less than the speed limit value and turn the PLC READY signal [Y0] from OFF to ON. |
| 1A69H | Outside speed limit value range | The setting value of the basic parameter 2 "[Pr.8] Speed limit value" is outside the setting range.<br>[Operation status at error occurrence]<br>When the PLC READY signal [Y0] is turned from OFF to ON: READY signal [X0] is not turned ON.<br>At start: The system does not operate. | When the PLC READY signal [Y0] is not turned ON after the setting is set within the setting range, turn the PLC READY signal [Y0] from OFF to ON. |

| Error code (Hexadecimal) | Error name | Error details and causes | Remedy |
|---|---|---|---|
| 1A6AH | Outside speed limit value range | The setting value of the basic parameter 2 "[Pr.8] Speed limit value" exceeds the command speed limit value.<br>[Operation status at error occurrence]<br>When the PLC READY signal [Y0] is turned from OFF to ON: READY signal [X0] is not turned ON.<br>At start: The system does not operate. | After the speed limit value is set so as not to exceed the command speed limit value, turn the PLC READY signal [Y0] from OFF to ON. |
| 1A6BH | Outside acceleration time 0 range | The setting value of the basic parameter 2 "Acceleration time 0" is outside the setting range.<br>[Operation status at error occurrence]<br>When the PLC READY signal [Y0] is turned from OFF to ON: READY signal [X0] is not turned ON.<br>At start: The system does not operate. | With the setting brought into the setting range, turn the PLC READY signal [Y0] from OFF to ON. |
| 1A6CH | Outside deceleration time 0 range | The setting value of the basic parameter 2 "Deceleration time 0" is outside the setting range.<br>[Operation status at error occurrence]<br>When the PLC READY signal [Y0] is turned from OFF to ON: READY signal [X0] is not turned ON.<br>At start: The system does not operate. | With the setting brought into the setting range, turn the PLC READY signal [Y0] from OFF to ON. |
| 1AA0H | Backlash compensation amount error | The calculation result of the following equation is smaller than 0 or larger than 4194304.<br>$0 \leq \frac{[Pr.11] \times [Pr.2]}{[Pr.3] \times [Pr.4]} \leq 4194303$<br>[Operation status at error occurrence]<br>The READY signal [X0] is not turned ON. | "[Pr.2] Number of pulses per rotation (AP)", "[Pr.3] Movement amount per rotation (AL)", "[Pr.4] Unit magnification (AM)", "[Pr.11] Backlash compensation amount"<br>Review the items above. |
| 1AA1H | Software stroke limit upper limit | In the unit of "degree", the setting value of the detailed parameter 1 "Software stroke limit upper limit value" is outside the setting range.<br>[Operation status at error occurrence]<br>The READY signal [X0] is not turned ON. | Correct the setting value and turn the PLC READY signal [Y0] from OFF to ON. |
| 1AA2H | Software stroke limit upper limit | In a unit other than "degree", the software stroke limit upper limit value is smaller than the setting value of the software stroke limit lower limit value.<br>[Operation status at error occurrence]<br>The READY signal [X0] is not turned ON. | In a unit other than "degree", set so that the "[Pr.13] Software stroke limit lower limit value" is smaller than the "[Pr.12] Software stroke limit upper limit value" and turn the PLC READY signal [Y0] from OFF to ON. |
| 1AA3H | Software stroke limit lower limit | In the unit of "degree", the setting value of the detailed parameter 1 "Software stroke limit lower limit value" is outside the setting range.<br>[Operation status at error occurrence]<br>The READY signal [X0] is not turned ON. | Correct the setting value and turn the PLC READY signal [Y0] from OFF to ON. |
| 1AA4H | Software stroke limit lower limit | In a unit other than "degree", the software stroke limit upper limit value is smaller than the setting value of the software stroke limit lower limit value.<br>[Operation status at error occurrence]<br>The READY signal [X0] is not turned ON. | In a unit other than "degree", set so that the "[Pr.13] Software stroke limit lower limit value" is smaller than the "[Pr.12] Software stroke limit upper limit value" and turn the PLC READY signal [Y0] from OFF to ON. |
| 1AA5H | Software stroke limit selection | • The setting value of the detailed parameter 1 "Software stroke limit selection" is outside the setting range.<br>• In the unit of "degree", "1: Apply software stroke limit on machine feed value" is set.<br>[Operation status at error occurrence]<br>The READY signal [X0] is not turned ON. | • Bring the setting into the setting range.<br>• In the unit of "degree", set "0: Apply software stroke limit on current feed value". |
| 1AA6H | Software stroke limit valid/invalid setting | The setting value of the detailed parameter 1 "Software stroke limit valid/invalid setting" is outside the setting range.<br>[Operation status at error occurrence]<br>The READY signal [X0] is not turned ON. | With the setting brought into the setting range, turn the PLC READY signal [Y0] from OFF to ON. |
| 1AA7H | Command in-position width | The setting value of the detailed parameter 1 "Command in-position width" is outside the setting range.<br>[Operation status at error occurrence]<br>The READY signal [X0] is not turned ON. | With the setting brought into the setting range, turn the PLC READY signal [Y0] from OFF to ON. |
| 1AA8H | Illegal torque limit setting value | The setting value of the detailed parameter 1 "Torque limit setting value" is outside the setting range.<br>[Operation status at error occurrence]<br>The READY signal [X0] is not turned ON. | With the setting brought into the setting range, turn the PLC READY signal [Y0] from OFF to ON. |

| Error code (Hexadecimal) | Error name | Error details and causes | Remedy |
|---|---|---|---|
| 1AA9H | M code ON timing error | The setting value of the detailed parameter 1 "M code ON signal output timing" is outside the setting range.<br>[Operation status at error occurrence]<br>The READY signal [X0] is not turned ON. | With the setting brought into the setting range, turn the PLC READY signal [Y0] from OFF to ON. |
| 1AAAH | Speed switching mode error | The setting value of the detailed parameter 1 "Speed switching mode" is outside the setting range.<br>[Operation status at error occurrence]<br>The READY signal [X0] is not turned ON. | With the setting brought into the setting range, turn the PLC READY signal [Y0] from OFF to ON. |
| 1AABH | Interpolation speed designation method error | The setting value of the detailed parameter 1 "Interpolation speed designation method" is outside the setting range.<br>[Operation status at error occurrence]<br>The READY signal [X0] is not turned ON. | With the setting brought into the setting range, turn the PLC READY signal [Y0] from OFF to ON. |
| 1AACH | Current value update request error | The setting value of the detailed parameter 1 "Current feed value during speed control" is outside the setting range.<br>[Operation status at error occurrence]<br>The READY signal [X0] is not turned ON. | With the setting brought into the setting range, turn the PLC READY signal [Y0] from OFF to ON. |
| 1AAEH | Speed-position function selection error | The detailed parameter 1 "Speed-position function selection" is preset to 2 and the following three conditions are not satisfied:<br>• Unit is "degree".<br>• Software stroke limits are invalid.<br>• Update current feed value.<br>[Operation status at error occurrence]<br>The READY signal [X0] is not turned ON. | • Speed-position switching control (ABS mode) should satisfy the conditions given on the left.<br>• When speed-position switching control (ABS mode) is not to be exercised, set 0 to speed-position function selection and turn the PLC READY signal [Y0] from OFF to ON. |
| 1AB1H | Acceleration time 1 setting error | The setting value of the detailed parameter 2 "Acceleration time 1" is outside the setting range.<br>[Operation status at error occurrence]<br>When the PLC READY signal [Y0] is turned from OFF to ON: The READY signal [X0] is not turned ON.<br>At start: The system does not start.<br>During operation: The system stops with the setting (deceleration stop/sudden stop) of the detailed parameter 2 sudden stop selection (stop group 3). (Note that the deceleration stop only occurs during the manual pulse generator operation.) | With the setting brought into the setting range, turn the PLC READY signal [Y0] from OFF to ON. |
| 1AB2H | Acceleration time 2 setting error | The setting value of the detailed parameter 2 "Acceleration time 2" is outside the setting range.<br>[Operation status at error occurrence]<br>When the PLC READY signal [Y0] is turned from OFF to ON: The READY signal [X0] is not turned ON.<br>At start: The system does not start.<br>During operation: The system stops with the setting (deceleration stop/sudden stop) of the detailed parameter 2 sudden stop selection (stop group 3). (Note that the deceleration stop only occurs during the manual pulse generator operation.) | With the setting brought into the setting range, turn the PLC READY signal [Y0] from OFF to ON. |
| 1AB3H | Acceleration time 3 setting error | The setting value of the detailed parameter 2 "Acceleration time 3" is outside the setting range.<br>[Operation status at error occurrence]<br>When the PLC READY signal [Y0] is turned from OFF to ON: The READY signal [X0] is not turned ON.<br>At start: The system does not start.<br>During operation: The system stops with the setting (deceleration stop/sudden stop) of the detailed parameter 2 sudden stop selection (stop group 3). (Note that the deceleration stop only occurs during the manual pulse generator operation.) | With the setting brought into the setting range, turn the PLC READY signal [Y0] from OFF to ON. |

| Error code (Hexadecimal) | Error name | Error details and causes | Remedy |
|---|---|---|---|
| 1AB4H | Deceleration time 1 setting error | The setting value of the detailed parameter 2 "Deceleration time 1" is outside the setting range.<br>[Operation status at error occurrence]<br>When the PLC READY signal [Y0] is turned from OFF to ON: The READY signal [X0] is not turned ON.<br>At start: The system does not start.<br>During operation: The system stops with the setting (deceleration stop/sudden stop) of the detailed parameter 2 sudden stop selection (stop group 3). (Note that the deceleration stop only occurs during the manual pulse generator operation.) | With the setting brought into the setting range, turn the PLC READY signal [Y0] from OFF to ON. |
| 1AB5H | Deceleration time 2 setting error | The setting value of the detailed parameter 2 "Deceleration time 2" is outside the setting range.<br>[Operation status at error occurrence]<br>When the PLC READY signal [Y0] is turned from OFF to ON: The READY signal [X0] is not turned ON.<br>At start: The system does not start.<br>During operation: The system stops with the setting (deceleration stop/sudden stop) of the detailed parameter 2 sudden stop selection (stop group 3). (Note that the deceleration stop only occurs during the manual pulse generator operation.) | With the setting brought into the setting range, turn the PLC READY signal [Y0] from OFF to ON. |
| 1AB6H | Deceleration time 3 setting error | The setting value of the detailed parameter 2 "Deceleration time 3" is outside the setting range.<br>[Operation status at error occurrence]<br>When the PLC READY signal [Y0] is turned from OFF to ON: The READY signal [X0] is not turned ON.<br>At start: The system does not start.<br>During operation: The system stops with the setting (deceleration stop/sudden stop) of the detailed parameter 2 sudden stop selection (stop group 3). (Note that the deceleration stop only occurs during the manual pulse generator operation.) | With the setting brought into the setting range, turn the PLC READY signal [Y0] from OFF to ON. |
| 1AB7H | JOG speed limit value error | The setting value of the detailed parameter 2 "[Pr.31] JOG speed limit value" is outside the setting range.<br>[Operation status at error occurrence]<br>When the PLC READY signal [Y0] is turned from OFF to ON: The READY signal [X0] is not turned ON.<br>At start: The system does not start. | When the PLC READY signal [Y0] is not turned ON after the setting value is corrected, turn the PLC READY signal [Y0] from OFF to ON. |
| 1AB8H | JOG speed limit value error | The setting value of the detailed parameter 2 "[Pr.31] JOG speed limit value" exceeds the "[Pr.8] Speed limit value".<br>[Operation status at error occurrence]<br>When the PLC READY signal [Y0] is turned from OFF to ON: The READY signal [X0] is not turned ON.<br>At start: The system does not start. | When the PLC READY signal [Y0] is not turned ON after the setting value is set to equal to or less than the "[Pr.8] Speed limit value", turn the PLC READY signal [Y0] from OFF to ON. |
| 1AB9H | JOG speed limit value error | The setting value of the detailed parameter 2 "[Pr.31] JOG speed limit value" is smaller than the "[Pr.7] Bias speed at start".<br>[Operation status at error occurrence]<br>When the PLC READY signal [Y0] is turned from OFF to ON: The READY signal [X0] is not turned ON.<br>At start: The system does not start. | When the PLC READY signal [Y0] is not turned ON after the setting value is set to equal to or more than the "[Pr.7] Bias speed at start", turn the PLC READY signal [Y0] from OFF to ON. |
| 1ABAH | Manual pulse generator speed limit value error | The setting value of the detailed parameter 2 "Manual pulse generator speed limit value" is outside the setting range.<br>[Operation status at error occurrence]<br>At the power on or when the PLC READY signal [Y0] is turned from OFF to ON: The READY signal [X0] is not turned ON.<br>At start: The system does not operate. | Correct the setting value and turn the PLC READY signal [Y0] from OFF to ON. |

| Error code (Hexadecimal) | Error name | Error details and causes | Remedy |
|---|---|---|---|
| 1ABBH | Manual pulse generator speed limit value error | The setting value of the detailed parameter 2 "Manual pulse generator speed limit value" exceeds the "speed limit value".<br>[Operation status at error occurrence]<br>At the power on or when the power supply is turned from OFF to ON, or the PLC READY signal [Y0] is turned from OFF to ON: The READY signal [X0] is not turned ON.<br>At start: The system does not operate. | Set a value equal to or less than the speed limit value. |
| 1ABCH | JOG acceleration time selection setting error | The setting value of the detailed parameter 2 "JOG operation acceleration time selection" is outside the setting range.<br>[Operation status at error occurrence]<br>When the PLC READY signal [Y0] is turned from OFF to ON: The READY signal [X0] is not turned ON.<br>At start: The system does not start.<br>During operation: The system stops with the setting (deceleration stop/sudden stop) of the detailed parameter 2 sudden stop selection (stop group 3). (Note that the deceleration stop only occurs during the manual pulse generator operation.) | With the setting brought into the setting range, turn the PLC READY signal [Y0] from OFF to ON. |
| 1ABDH | JOG deceleration time selection setting error | The setting value of the detailed parameter 2 "JOG operation deceleration time selection" is outside the setting range.<br>[Operation status at error occurrence]<br>When the PLC READY signal [Y0] is turned from OFF to ON: The READY signal [X0] is not turned ON.<br>At start: The system does not start.<br>During operation: The system stops with the setting (deceleration stop/sudden stop) of the detailed parameter 2 sudden stop selection (stop group 3). (Note that the deceleration stop only occurs during the manual pulse generator operation.) | With the setting brought into the setting range, turn the PLC READY signal [Y0] from OFF to ON. |
| 1ABEH | Acceleration/ deceleration process selection setting error | The setting value of the detailed parameter 2 "Acceleration/deceleration process selection" is outside the setting range.<br>[Operation status at error occurrence]<br>When the PLC READY signal [Y0] is turned from OFF to ON: The READY signal [X0] is not turned ON.<br>At start: The system does not start.<br>During operation: The system stops with the setting (deceleration stop/sudden stop) of the detailed parameter 2 sudden stop selection (stop group 3). (Note that the deceleration stop only occurs during the manual pulse generator operation.) | With the setting brought into the setting range, turn the PLC READY signal [Y0] from OFF to ON. |
| 1ABFH | S-curve ratio setting error | The setting value of the detailed parameter 2 "S-curve ratio" is outside the setting range.<br>[Operation status at error occurrence]<br>When the PLC READY signal [Y0] is turned from OFF to ON: The READY signal [X0] is not turned ON.<br>At start: The system does not start.<br>During operation: The system stops with the setting (deceleration stop/sudden stop) of the detailed parameter 2 sudden stop selection (stop group 3). (Note that the deceleration stop only occurs during the manual pulse generator operation.) | With the setting brought into the setting range, turn the PLC READY signal [Y0] from OFF to ON. |
| 1AC0H | Illegal sudden stop deceleration time | The setting value of the detailed parameter 2 "Sudden stop deceleration time" is outside the setting range.<br>[Operation status at error occurrence]<br>When the PLC READY signal [Y0] is turned from OFF to ON: The READY signal [X0] is not turned ON.<br>At start: The system does not start.<br>During operation: The system stops with the setting (deceleration stop/sudden stop) of the detailed parameter 2 sudden stop selection (stop group 3). (Note that the deceleration stop only occurs during the manual pulse generator operation.) | With the setting brought into the setting range, turn the PLC READY signal [Y0] from OFF to ON. |

| Error code (Hexadecimal) | Error name | Error details and causes | Remedy |
|---|---|---|---|
| 1AC1H | Stop group 1 sudden stop selection error | The setting value of the detailed parameter 2 "Stop group 1 sudden stop selection" is outside the setting range.<br>[Operation status at error occurrence]<br>When the PLC READY signal [Y0] is turned from OFF to ON: The READY signal [X0] is not turned ON.<br>At start: The system does not start.<br>During operation: The system stops with the setting (deceleration stop/sudden stop) of the detailed parameter 2 sudden stop selection (stop group 3). (Note that the deceleration stop only occurs during the manual pulse generator operation.) | With the setting brought into the setting range, turn the PLC READY signal [Y0] from OFF to ON. |
| 1AC2H | Stop group 2 sudden stop selection error | The setting value of the detailed parameter 2 "Stop group 2 sudden stop selection" is outside the setting range.<br>[Operation status at error occurrence]<br>When the PLC READY signal [Y0] is turned from OFF to ON: The READY signal [X0] is not turned ON.<br>At start: The system does not start.<br>During operation: The system stops with the setting (deceleration stop/sudden stop) of the detailed parameter 2 sudden stop selection (stop group 3). (Note that the deceleration stop only occurs during the manual pulse generator operation.) | With the setting brought into the setting range, turn the PLC READY signal [Y0] from OFF to ON. |
| 1AC3H | Stop group 3 sudden stop selection error | The setting value of the detailed parameter 2 "Stop group 3 sudden stop selection" is outside the setting range.<br>[Operation status at error occurrence]<br>When the PLC READY signal [Y0] is turned from OFF to ON: The READY signal [X0] is not turned ON.<br>At start: The system does not start.<br>During operation: The system stops with the setting (deceleration stop/sudden stop) of the detailed parameter 2 sudden stop selection (stop group 3). (Note that the deceleration stop only occurs during the manual pulse generator operation.) | With the setting brought into the setting range, turn the PLC READY signal [Y0] from OFF to ON. |
| 1AC4H | Outside allowance circular interpolation error width | The setting value of the detailed parameter 2 "Allowance circular interpolation error width" is outside the setting range.<br>[Operation status at error occurrence]<br>When the PLC READY signal [Y0] is turned from OFF to ON: The READY signal [X0] is not turned ON.<br>At start: The system does not start.<br>During operation: The system stops with the setting (deceleration stop/sudden stop) of the detailed parameter 2 sudden stop selection (stop group 3). (Note that the deceleration stop only occurs during the manual pulse generator operation.) | With the setting brought into the setting range, turn the PLC READY signal [Y0] from OFF to ON. |
| 1AC5H | External command function selection error | The setting value of the detailed parameter 2 "External command function selection" is outside the setting range.<br>[Operation status at error occurrence]<br>When the PLC READY signal [Y0] is turned from OFF to ON: The READY signal [X0] is not turned ON.<br>At start: The system does not start.<br>During operation: The system stops with the setting (deceleration stop/sudden stop) of the detailed parameter 2 sudden stop selection (stop group 3). (Note that the deceleration stop only occurs during the manual pulse generator operation.) | With the setting brought into the setting range, turn the PLC READY signal [Y0] from OFF to ON. |
| 1AC6H | Manual pulse generator speed limit mode error | The setting value of the detailed parameter 2 "[Pr.122] Manual pulse generator speed limit mode" is outside the setting range.<br>[Operation status at error occurrence]<br>At the power on or when the PLC READY signal [Y0] is turned from OFF to ON: The READY signal [X0] is not turned ON.<br>At start: The system does not operate. | Correct the setting value and turn the PLC READY signal [Y0] from OFF to ON. |

| Error code (Hexadecimal) | Error name | Error details and causes | Remedy |
|---|---|---|---|
| 1ACAH | External input signal selection error | The setting value of the detailed parameter 1 "External input signal selection" is outside the setting range.<br>[Operation status at error occurrence]<br>The READY signal [X0] is not turned ON. | With the setting brought into the setting range, turn the PLC READY signal [Y0] from OFF to ON. |
| 1ACBH | Input signal logic selection setting error | The setting values of the detailed parameter 1 "Input signal logic selection" are different in the axis that uses the same input signal.<br>[Operation status at error occurrence]<br>The READY signal [X0] is not turned ON. | With the setting of the axis is matched, turn the PLC READY signal [Y0] from OFF to ON. |
| 1ACCH | Restart allowable range error | The setting value of the detailed parameter 2 "Restart allowable range when servo OFF to ON" is outside the setting range.<br>[Operation status at error occurrence]<br>When the PLC READY signal [Y0] is turned from OFF to ON: The READY signal [X0] is not turned ON.<br>At start: The system does not start.<br>During operation: The system stops with the setting (deceleration stop/sudden stop) of the detailed parameter 2 sudden stop selection (stop group 3). (Note that the deceleration stop only occurs during the manual pulse generator operation.) | With the setting brought into the setting range, turn the PLC READY signal [Y0] from OFF to ON. |
| 1ACDH | Speed control 10 × multiplier setting for degree axis error | The setting value of the detailed parameter 2 "Speed control 10 × multiplier setting for degree axis" is outside the setting range.<br>[Operation status at error occurrence]<br>The READY signal [X0] is not turned ON. | With the setting brought into the setting range, turn the PLC READY signal [Y0] from OFF to ON. |
| 1ACEH | Operation setting for speed-torque control mode error | The setting value of the detailed parameter 2 "Operation setting for speed-torque control mode" is outside the setting range.<br>[Operation status at error occurrence]<br>The READY signal [X0] is not turned ON. | With the setting brought into the setting range, turn the PLC READY signal [Y0] from OFF to ON. |
| 1ACFH | External command signal selection error | The setting value of the detailed parameter 2 "External command signal selection" is outside the setting range.<br>[Operation status at error occurrence]<br>The READY signal [X0] is not turned ON. | With the setting brought into the setting range, turn the PLC READY signal [Y0] from OFF to ON. |
| 1AD0H | FLS signal selection error | The setting value of the detailed parameter 1 "FLS signal selection" is outside the setting range.<br>[Operation status at error occurrence]<br>The READY signal [X0] is not turned ON. | Correct the setting value and turn the PLC READY signal [Y0] from OFF to ON. |
| 1AD1H | RLS signal selection error | The setting value of the detailed parameter 1 "RLS signal selection" is outside the setting range.<br>[Operation status at error occurrence]<br>The READY signal [X0] is not turned ON. | Correct the setting value and turn the PLC READY signal [Y0] from OFF to ON. |
| 1AD2H | DOG signal selection error | The setting value of the detailed parameter 1 "DOG signal selection" is outside the setting range.<br>[Operation status at error occurrence]<br>The READY signal [X0] is not turned ON. | Correct the setting value and turn the PLC READY signal [Y0] from OFF to ON. |
| 1AD3H | STOP signal selection error | The setting value of the detailed parameter 1 "STOP signal selection" is outside the setting range.<br>[Operation status at error occurrence]<br>The READY signal [X0] is not turned ON. | Correct the setting value and turn the PLC READY signal [Y0] from OFF to ON. |
| 1B00H | Home position return method error | The setting value of the home position return basic parameter "Home position return method" is outside the setting range.<br>[Operation status at error occurrence]<br>The READY signal [X0] is not turned ON. | With the setting brought into the setting range, turn the PLC READY signal [Y0] from OFF to ON. |
| 1B01H | Home position return direction error | The setting value of the home position return basic parameter "Home position return direction" is outside the setting range.<br>[Operation status at error occurrence]<br>The READY signal [X0] is not turned ON. | With the setting brought into the setting range, turn the PLC READY signal [Y0] from OFF to ON. |
| 1B02H | Home position address setting error | The setting value of the home position return basic parameter "Home position address" is outside the setting range.<br>[Operation status at error occurrence]<br>The READY signal [X0] is not turned ON. | With the setting brought into the setting range, turn the PLC READY signal [Y0] from OFF to ON. |

| Error code (Hexadecimal) | Error name | Error details and causes | Remedy |
|---|---|---|---|
| 1B03H | Home position return speed error | The setting value of the home position return basic parameter "[Pr.46] Home position return speed" is outside the setting range.<br>[Operation status at error occurrence]<br>The READY signal [X0] is not turned ON. | Correct the setting value and turn the PLC READY signal [Y0] from OFF to ON. |
| 1B04H | Home position return speed error | The setting value of the home position return basic parameter "[Pr.46] Home position return speed" exceeds the "[Pr.8] Speed limit value".<br>[Operation status at error occurrence]<br>The READY signal [X0] is not turned ON. | After the setting value is equal to or less than the "[Pr.8] Speed limit value", turn the PLC READY signal [Y0] from OFF to ON. |
| 1B05H | Home position return speed error | The setting value of the home position return basic parameter "[Pr.46] Home position return speed" is smaller than "[Pr.7] Bias speed at start".<br>[Operation status at error occurrence]<br>The READY signal [X0] is not turned ON. | After the setting value is set to equal to or more than "[Pr.7] Bias speed at start", turn the PLC READY signal [Y0] from OFF to ON. |
| 1B06H | Creep speed error | The setting value of the home position return basic parameter "[Pr.47] Creep speed" is outside the setting range.<br>[Operation status at error occurrence]<br>The READY signal [X0] is not turned ON. | Correct the setting value and turn the PLC READY signal [Y0] from OFF to ON. |
| 1B07H | Creep speed error | The setting value of the home position return basic parameter "[Pr.47] Creep speed" is larger than the "[Pr.46] Home position return speed".<br>[Operation status at error occurrence]<br>The READY signal [X0] is not turned ON. | After the setting value is set to equal to or less than the "[Pr.46] Home position return speed", turn the PLC READY signal [Y0] from OFF to ON. |
| 1B08H | Creep speed error | The setting value of the home position return basic parameter "[Pr.47] Creep speed" is smaller than the "[Pr.7] Bias speed at start".<br>[Operation status at error occurrence]<br>The READY signal [X0] is not turned ON. | After the setting value is set to equal to or more than the "[Pr.7] Bias speed at start", turn the PLC READY signal [Y0] from OFF to ON. |
| 1B09H | Home position return retry error | The setting value of the home position return basic parameter "Home position return retry" is outside the setting range.<br>[Operation status at error occurrence]<br>The READY signal [X0] is not turned ON. | With the setting brought into the setting range, turn the PLC READY signal [Y0] from OFF to ON. |
| 1B0AH | Setting for the movement amount after near-point dog ON error | The setting value of the home position return detailed parameter "Setting for the movement amount after near-point dog ON" is outside the setting range.<br>[Operation status at error occurrence]<br>The READY signal [X0] is not turned ON. | With the setting brought into the setting range, turn the PLC READY signal [Y0] from OFF to ON. |
| 1B0BH | Home position return acceleration time selection error | The setting value of the home position return detailed parameter "Home position return acceleration time selection" is outside the setting range.<br>[Operation status at error occurrence]<br>The READY signal [X0] is not turned ON. | With the setting brought into the setting range, turn the PLC READY signal [Y0] from OFF to ON. |
| 1B0CH | Home position return deceleration time selection error | The setting value of the home position return detailed parameter "Home position return deceleration time selection" is outside the setting range.<br>[Operation status at error occurrence]<br>The READY signal [X0] is not turned ON. | With the setting brought into the setting range, turn the PLC READY signal [Y0] from OFF to ON. |
| 1B0DH | Home position return torque limit value error | The setting value of the home position return detailed parameter "Home position return torque limit value" is outside the setting range.<br>[Operation status at error occurrence]<br>The READY signal [X0] is not turned ON. | With the setting brought into the setting range, turn the PLC READY signal [Y0] from OFF to ON. |
| 1B0EH | Home position return torque limit value error | The home position return detailed parameter "Home position return torque limit value" has exceeded the detailed parameter 1 "Torque limit setting value".<br>[Operation status at error occurrence]<br>The READY signal [X0] is not turned ON. | With the setting brought into the setting range, turn the PLC READY signal [Y0] from OFF to ON. |
| 1B10H | Speed designation during home position shift error | The setting value of the home position return detailed parameter "Speed designation during home position shift" is outside the setting range.<br>[Operation status at error occurrence]<br>The READY signal [X0] is not turned ON. | With the setting brought into the setting range, turn the PLC READY signal [Y0] from OFF to ON. |

| Error code (Hexadecimal) | Error name | Error details and causes | Remedy |
|---|---|---|---|
| 1B11H | Operation setting for incompletion of home position return error | The setting value of the home position return detailed parameter "Operation setting for incompletion of home position return" is outside the setting range.<br>[Operation status at error occurrence]<br>The READY signal [X0] is not turned ON. | With the setting brought into the setting range, turn the PLC READY signal [Y0] from OFF to ON. |
| 1B70H | Manual pulse generator/ Incremental synchronous encoder input selection error | The setting value of the detailed parameter 1 "Manual pulse generator/Incremental synchronous encoder input selection" is outside the setting range.<br>[Operation status at error occurrence]<br>The READY signal [X0] is not turned ON. | With the setting brought into the setting range, turn the PLC READY signal [Y0] from OFF to ON. |
| 1B71H | Forced stop valid/ invalid setting error | The setting value of the detailed parameter 1 "Forced stop valid/invalid setting" is outside the setting range.<br>[Operation status at error occurrence]<br>The READY signal [X0] is not turned ON. | With the setting brought into the setting range, turn the PLC READY signal [Y0] from OFF to ON. |
| 1B72H | Manual pulse generator/ Incremental synchronous encoder input type selection error | The setting value of the detailed parameter 2 "Manual pulse generator/Incremental synchronous encoder input type selection" is outside the setting range.<br>[Operation status at error occurrence]<br>The communication between servo amplifiers of target axis is not executed.<br>(The servo amplifier's LED display remains "Ab".) | With the setting brought into the setting range, turn the PLC READY signal [Y0] from OFF to ON. |
| 1B73H | Operation cycle setting error | The setting value of the common parameter "Operation cycle setting" is outside the setting range.<br>[Operation status at error occurrence]<br>The READY signal [X0] is not turned ON. | With the setting brought into the setting range, write to the flash ROM and switch the power on again or reset the PLC. |
| 1B75H | Manual pulse generator/ Incremental synchronous encoder input logic selection error | The setting value of the common parameter "[Pr.151] Manual pulse generator/Incremental synchronous encoder input logic selection" is outside the setting range.<br>[Operation status at error occurrence]<br>The READY signal [X0] is not turned ON. | Correct the setting value and turn the PLC READY signal [Y0] from OFF to ON. |
| 1BAAH | Synchronous encoder via servo amplifier invalid error | • The servo amplifier axis set as synchronous encoder via servo amplifier is not supported with scale measurement mode.<br>• In system construction, the unset up servo amplifier axis is set as the synchronous encoder via servo amplifier.<br>• In system construction, the axis set to "Invalid" at the external synchronization encoder input is set as the synchronous encoder via servo amplifier.<br>• The servo amplifier axis set as synchronous encoder via servo amplifier is connected to the encoder except Q171ENC-W8 (including the linear scale, etc.).<br>[Operation status at error occurrence]<br>The READY signal [X0] is not turned ON. | With the setting brought into the setting range, switch the power on again or reset the PLC. |
| 1C80H | Driver error | Errors occur in the driver.<br>[Operation status at error occurrence]<br>The system stops immediately. | Confirm the alarm code by "[Md.114] Servo alarm" and refer to the driver instruction manual for details. |
| 1C81H | Communication retry counter error | The Simple Motion module detects the communication retry counter errors with the driver.<br>[Operation status at error occurrence]<br>The system stops immediately.<br>(The driver stops by the communication error.) | • Check the SSCNETⅢ cable. (Connection error or damage)<br>• Replace the driver in which the alarm (communication error) occurred.<br>• Replace the Simple Motion module. |
| 1C82H | WDT error | The Simple Motion module detects the WDT error of the driver.<br>[Operation status at error occurrence]<br>The system stops immediately. | Replace the driver in which the WDT occurred. |
| 1C83H | Unsupported operation cycle | The setting value of the operation cycle to which amplifier does not correspond is set up.<br>[Operation status at error occurrence]<br>The system stops immediately. | With the setting brought into the supported range, switch the power on again or reset the PLC. |

| Error code (Hexadecimal) | Error name | Error details and causes | Remedy |
|---|---|---|---|
| 1C90H | Number of master axis error | Number of axes set for the master axis in servo parameter "Driver communication setting (PD15)" exceed the setting range.<br>[Operation status at error occurrence]<br>The READY signal [X0] is not turned ON. | Set the number of master axis not more than the number can be set in servo parameter "PD15". |
| 1C91H | Master axis No. error | Servo parameters "Driver communication setting Master axis No. selection (1 to 4) for slave (PD20 to PD23)" are set the self axis.<br>[Operation status at error occurrence]<br>The READY signal [X0] is not turned ON. | Review the master axis No. of servo parameters "PD20 to PD23". |
| 1C92H | Master axis setting error | Not setting the master axis in Servo parameters" Driver communication setting Master axis No. selection (1 to 4) for slave (PD20 to PD23) ".<br>[Operation status at error occurrence]<br>The READY signal [X0] is not turned ON. | Review the master axis No. of servo parameters "PD20 to PD23". |
| 1C93H | Driver communication setting error | • Setting the driver communication to servo amplifier which does not support the driver communication.<br>• The driver communication setting is different in the module and the servo amplifier.<br>[Operation status at error occurrence]<br>The READY signal [X0] is not turned ON. | • Confirm the driver communication and the actually connected servo amplifier.<br>• After setting 'The driver communication setting', write to a flash ROM and switch the power on again or reset the PLC. After that turning the power of servo amplifier on again, switch the power on again or reset the PLC. |
| 2610H | Inter-module synchronization signal fault | Inter-module synchronization fault is detected.<br>[Operation status at error occurrence]<br>The READY signal [X0] is not turned ON. | • Take measures against noise.<br>• After the Simple Motion module is reset, switch to RUN. If the same error is displayed again, the hardware fault might occur in the CPU module, base unit, extension cable or Simple Motion module. Please consult your sales representative. |
| 2611H | Inter-module synchronization signal fault | Inter-module synchronization fault is detected.<br>[Operation status at error occurrence]<br>The READY signal [X0] is not turned ON. | • Take measures against noise.<br>• After the Simple Motion module is reset, switch to RUN. If the same error is displayed again, the hardware fault might occur in the CPU module, base unit, extension cable or Simple Motion module. Please consult your sales representative. |
| 3001H | Faults | Hardware is faulty.<br>[Operation status at error occurrence]<br>The system stops. | Check that there is no influence from noise. |
| 3002H | Internal circuit fault | Hardware is faulty.<br>[Operation status at error occurrence]<br>The system stops. | Check that there is no influence from noise. |
| 3010H | F/W error | Hardware is faulty.<br>[Operation status at error occurrence]<br>The system stops. | Replace the Simple Motion module. |
| 3020H | CPU module error | An error is detected in the CPU module.<br>[Operation status at error occurrence]<br>At start: The system does not operate.<br>During operation: The system stops with the setting (deceleration stop/sudden stop) of the detailed parameter 2 sudden stop selection (stop group 2). (Note that the deceleration stop only occurs during the manual pulse generator operation.) | Check the error of the CPU module and take corrective action using the module diagnostics. |
| 3021H | CPU module error | An error is detected in the CPU module.<br>[Operation status at error occurrence]<br>At start: The system does not operate.<br>During operation: The system stops with the setting (deceleration stop/sudden stop) of the detailed parameter 2 sudden stop selection (stop group 2). (Note that the deceleration stop only occurs during the manual pulse generator operation.) | Check the error of the CPU module and take corrective action using the module diagnostics. |

*1 Setting condition: "[Cd.16] Inching movement amount × (A) ≤ [Pr.31] JOG speed limit value"
Use the following values for (A).

| Unit setting | Operation cycle | | | |
|---|---|---|---|---|
| | 0.444 ms | 0.888 ms | 1.777 ms | 3.555 ms |
| When unit is set to pulse | 2250 | 1125 | 562.5 | 281.25 |
| When unit is set to degree and "[Pr.83] Speed control 10 × multiplier setting for degree axis" is valid | 135 | 67.5 | 33.75 | 16.875 |
| When unit setting is other than the above | 1350 | 675 | 337.5 | 168.75 |

Errors related to synchronous control are described below.

| Error code (Hexadecimal) | Error name | Error details and causes | Remedy |
|---|---|---|---|
| 1BA0H | Outside input axis type setting range | Setting values of input axis parameters "[Pr.300] Servo input axis type" and "[Pr.320] Synchronous encoder axis type" are outside the setting range.<br>[Operation status at error occurrence]<br>The setting becomes invalid for input axis. | Set a value within the setting range. |
| 1BA1H | Outside input axis unit setting range | Setting value of the input axis parameter "[Pr.321] Synchronous encoder axis unit setting" is outside the setting range.<br>[Operation status at error occurrence]<br>The setting becomes invalid for input axis. | Set a value within the setting range. |
| 1BA2H | Outside input axis unit conversion denominator range | The input axis parameter "[Pr.323] Synchronous encoder axis unit conversion: Denominator" is set to 0 or lower.<br>[Operation status at error occurrence]<br>The setting becomes invalid for input axis. | Set a value within the range of 1 to 2147483647. |
| 1BA3H | Outside input axis length per cycle range | The input axis parameter "[Pr.324] Synchronous encoder axis length per cycle" is set to 0 or lower.<br>[Operation status at error occurrence]<br>The setting becomes invalid for input axis. | Set a value within the range of 1 to 2147483647. |
| 1BA4H | Outside input axis smoothing time constant range | The input axis parameters "[Pr.301] Servo input axis smoothing time constant" and "[Pr.325] Synchronous encoder axis smoothing time constant" are set other than 0 to 5000.<br>[Operation status at error occurrence]<br>The setting becomes invalid for input axis. | Set a value within the range of 0 to 5000. |
| 1BA5H | Outside input axis rotation direction restriction setting range | The input axis parameters "[Pr.304] Servo input axis rotation direction restriction" and "[Pr.328] Synchronous encoder axis rotation direction restriction" are set other than 0 to 2.<br>[Operation status at error occurrence]<br>The setting becomes invalid for input axis. | Set a value within the range of 0 to 2. |
| 1BA6H | Input axis unit conversion overflow | Internal operation overflow occurred because the unit conversion ratio (unit conversion: Numerator/unit conversion: Denominator) of the input axis is too large.<br>[Operation status at error occurrence]<br>The input axis operation is immediately stopped, and a connection becomes invalid. | • Set a smaller unit conversion ratio (unit conversion: Numerator/unit conversion: Denominator) of the input axis.<br>• Decrease the input axis speed. |
| 1BA7H | Speed-position switching control start in servo input axis not possible | When the input axis parameter "[Pr.300] Servo input axis type" is current feed value or read current value, the speed-position switching control is started with the detailed parameter 1 "[Pr.21] Current feed value during speed control" set to other than "1:Update of current feed value".<br>[Operation status at error occurrence]<br>The speed-position switching control does not start. | • Set "[Pr.300] Servo input axis type" to "Servo command value" or "Feedback value".<br>• Set "[Pr.21] Current feed value during speed control" to "1:Update of current feed value". |
| 1BA8H | Synchronous encoder via servo amplifier communication error | • The hardware of the synchronous encoder or the servo amplifier is faulty.<br>• The synchronous encoder cable is disconnected.<br>• Communication to the synchronous encoder cannot be established.<br>[Operation status at error occurrence]<br>The connection of synchronous encoder axis becomes invalid. | • Replace the synchronous encoder or the servo amplifier.<br>• Check the synchronous encoder cable.<br>• Check the connected synchronous encoder.<br>• Check whether the synchronous encoder cable is faulty. |
| 1BA9H | Synchronous encoder via servo amplifier battery error | The battery which the servo amplifier connected synchronous encoder is empty or the battery is disconnected.<br>[Operation status at error occurrence]<br>The synchronous encoder control continues. | Replace the battery or check the battery connection of the servo amplifier. |
| 1BE0H | Outside main input axis No. range | • Setting value of the synchronous parameter "[Pr.400] Main input axis No." is outside the setting range.<br>• The same servo input axis No. as the output axis is set in the synchronous parameter "[Pr.400] Main input axis No.".<br>[Operation status at error occurrence]<br>Synchronous control does not start. | • Set within the range.<br>• Do not set up the same servo input axis number as the output axis. |

| Error code (Hexadecimal) | Error name | Error details and causes | Remedy |
|---|---|---|---|
| 1BE1H | Outside sub input axis No. range | • Setting value of the synchronous parameter "[Pr.401] Sub input axis No." is outside the setting range.<br>• The same servo input axis No. as the output axis is set in the synchronous parameter "[Pr.401] Sub input axis No.".<br>[Operation status at error occurrence]<br>Synchronous control does not start. | • Set within the range.<br>• Do not set up the same servo input axis number as the output axis. |
| 1BE2H | Outside main shaft gear: denominator range | The synchronous parameter "[Pr.404] Main shaft gear: Denominator" is set to 0 or lower.<br>[Operation status at error occurrence]<br>Synchronous control does not start. | Set a value within the range of 1 to 2147483647. |
| 1BE3H | Main shaft gear operation overflow | Overflow (sign reversion) occurred in input values, because the main shaft gear ratio is too large.<br>[Operation status at error occurrence]<br>Synchronous control is immediately stopped. | • Set a smaller absolute value for the synchronous parameter "[Pr.403] Main shaft gear: Numerator".<br>• Set a larger value for the synchronous parameter "[Pr.404] Main shaft gear: Denominator".<br>• Decrease the input axis speed. |
| 1BE4H | Outside main shaft clutch control setting range | Setting value of the synchronous parameter "[Pr.405] Main shaft clutch control setting" is outside the setting range.<br>[Operation status at error occurrence]<br>Synchronous control does not start. | Set within the range. |
| 1BE5H | Outside main shaft clutch reference address setting range | Setting value of the synchronous parameter "[Pr.406] Main shaft clutch reference address setting" is outside the setting range.<br>[Operation status at error occurrence]<br>Synchronous control does not start. | Set within the range. |
| 1BE6H | Outside main shaft clutch smoothing method range | Setting value of the synchronous parameter "[Pr.411] Main shaft clutch smoothing method" is outside the setting range.<br>[Operation status at error occurrence]<br>Synchronous control does not start. | Set within the range. |
| 1BE7H | Outside main shaft clutch smoothing time constant range | Setting value of the synchronous parameter "[Pr.412] Main shaft clutch smoothing time constant" is outside the setting range.<br>[Operation status at error occurrence]<br>Synchronous control does not start. | Set within the range. |
| 1BE8H | Composite main shaft gear operation overflow | The composite value is overflowed (sign reverse) because the input values of main input axis and sub input axis are large.<br>[Operation status at error occurrence]<br>Synchronous control is immediately stopped. | Lower the input values of main input axis and sub input axis. |
| 1BF0H | Outside auxiliary shaft axis No. range | • Setting value of the synchronous parameter "[Pr.418] Auxiliary shaft axis No." is outside the setting range.<br>• The same servo input axis No. as the output axis is set in the synchronous parameter "[Pr.418] Auxiliary shaft axis No.".<br>[Operation status at error occurrence]<br>Synchronous control does not start. | • Set within the range.<br>• Do not set the same servo input axis number of the output axis. |
| 1BF2H | Outside auxiliary shaft gear: denominator range | The synchronous parameter "[Pr.421] Auxiliary shaft gear: Denominator" is set to 0 or lower.<br>[Operation status at error occurrence]<br>Synchronous control does not start. | Set a value within the range of 1 to 2147483647. |
| 1BF3H | Auxiliary shaft gear operation overflow | Overflow (sign reversion) occurred in input values, because the auxiliary shaft gear ratio is too large.<br>[Operation status at error occurrence]<br>Synchronous control is immediately stopped. | • Set a smaller absolute value for the synchronous parameter "[Pr.420] Auxiliary shaft gear: Numerator".<br>• Set a larger value for the synchronous parameter "[Pr.421] Auxiliary shaft gear: Denominator".<br>• Decrease the input axis speed. |
| 1BF4H | Outside auxiliary shaft clutch control setting range | Setting value of the synchronous parameter "[Pr.422] Auxiliary shaft clutch control setting" is outside the setting range.<br>[Operation status at error occurrence]<br>Synchronous control does not start. | Set within the range. |

| Error code (Hexadecimal) | Error name | Error details and causes | Remedy |
|---|---|---|---|
| 1BF5H | Outside auxiliary shaft clutch reference address setting range | Setting value of the synchronous parameter "[Pr.423] Auxiliary shaft clutch reference address setting" is outside the setting range.<br>[Operation status at error occurrence]<br>Synchronous control does not start. | Set within the range. |
| 1BF6H | Outside auxiliary shaft clutch smoothing method range | Setting value of the synchronous parameter "[Pr.428] Auxiliary shaft clutch smoothing method" is outside the setting range.<br>[Operation status at error occurrence]<br>Synchronous control does not start. | Set within the range. |
| 1BF7H | Outside auxiliary shaft clutch smoothing time constant range | Setting value of the synchronous parameter "[Pr.429] Auxiliary shaft clutch smoothing time constant" is outside the setting range.<br>[Operation status at error occurrence]<br>Synchronous control does not start. | Set within the range. |
| 1BF8H | Composite auxiliary shaft gear operation overflow | The composite value is overflowed (sign reverse) because the input values of main shaft and auxiliary shaft are large.<br>[Operation status at error occurrence]<br>Synchronous control is immediately stopped. | Lower the input values of main shaft and auxiliary shaft. |
| 1C00H | Outside speed change gear range | Setting value of the synchronous parameter "[Pr.434] Speed change gear" is outside the setting range.<br>[Operation status at error occurrence]<br>Synchronous control does not start. | Set within the range. |
| 1C01H | Outside speed change ratio: denominator range | The synchronous parameter "[Pr.437] Speed change ratio: Denominator" is set to 0 or lower.<br>[Operation status at error occurrence]<br>Synchronous control does not start. | Set a value within the range of 1 to 2147483647. |
| 1C02H | Outside speed change gear smoothing time constant range | The synchronous parameter "[Pr.435] Speed change gear smoothing time constant" is set other than 0 to 5000.<br>[Operation status at error occurrence]<br>Synchronous control does not start. | Set a value within the range of 0 to 5000. |
| 1C03H | Speed change gear overflow | Overflow (sign reversion) occurred in input values, because the speed change ratio of speed change gear is too large.<br>[Operation status at error occurrence]<br>Synchronous control is immediately stopped. | • Set a smaller absolute value for the synchronous parameter "[Pr.436] Speed change ratio: Numerator".<br>• Set a larger value for the synchronous parameter "[Pr.437] Speed change ratio: Denominator".<br>• Decrease the input axis speed. |
| 1C10H | Outside cam No. range | The synchronous parameter "[Pr.440] Cam No." is set to other than 0 to 256.<br>[Operation status at error occurrence]<br>Synchronous control does not start. | Set a value within the range of 0 to 256. |
| 1C11H | Cam not registered | Cam data specified in the synchronous parameter "[Pr.440] Cam No." does not exist on the cam open area.<br>[Operation status at error occurrence]<br>Synchronous control does not start. | Specify the cam No. of an existing cam data. |
| 1C12H | Outside cam axis length per cycle range | The synchronous parameter "[Pr.439] Cam axis length per cycle" is set to 0 or lower.<br>[Operation status at error occurrence]<br>Synchronous control does not start. | Set a value within the range of 1 to 2147483647. |
| 1C13H | Outside output axis smoothing time constant range | The synchronous parameter "[Pr.447] Output axis smoothing time constant" is set to other than 0 to 5000.<br>[Operation status at error occurrence]<br>Synchronous control does not start. | Set a value within the range of 0 to 5000. |
| 1C20H | Outside setting method of current value per cycle after main shaft gear range | The synchronous parameter "[Pr.460] Setting method of current value per cycle after main shaft gear" is set to other than 0 to 2.<br>[Operation status at error occurrence]<br>Synchronous control does not start. | Set a value within the range of 0 to 2. |

| Error code (Hexadecimal) | Error name | Error details and causes | Remedy |
|---|---|---|---|
| 1C21H | Outside current value per cycle after main shaft gear (Initial setting) range | The synchronous parameter "[Pr.465] Current value per cycle after main shaft gear (Initial setting)" is other than 0 to (Cam axis length per cycle - 1).<br>[Operation status at error occurrence]<br>Synchronous control does not start. | Set within the range of 0 to (Cam axis length per cycle - 1). |
| 1C22H | Outside setting method of current value per cycle after auxiliary shaft gear range | The synchronous parameter "[Pr.461] Setting method of current value per cycle after auxiliary shaft gear" is set to other than 0 to 2.<br>[Operation status at error occurrence]<br>Synchronous control does not start. | Set a value within the range of 0 to 2. |
| 1C23H | Outside current value per cycle after auxiliary shaft gear (Initial setting) range | The synchronous parameter "[Pr.466] Current value per cycle after auxiliary shaft gear (Initial setting)" is other than 0 to (Cam axis length per cycle - 1).<br>[Operation status at error occurrence]<br>Synchronous control does not start. | Set within the range of 0 to (Cam axis length per cycle - 1). |
| 1C24H | Outside cam axis position restoration object range | The synchronous parameter "[Pr.462] Cam axis position restoration object" is set to other than 0 to 2.<br>[Operation status at error occurrence]<br>Synchronous control does not start. | Set a value within the range of 0 to 2. |
| 1C25H | Outside setting method of cam reference position range | The synchronous parameter "[Pr.463] Setting method of cam reference position " is set to other than 0 to 2.<br>[Operation status at error occurrence]<br>Synchronous control does not start. | Set a value within the range of 0 to 2. |
| 1C26H | Outside setting method of cam axis current value per cycle range | • The synchronous parameter "[Pr.464] Setting method of cam axis current value per cycle" is set to other than 0 to 3.<br>• "3: Current value per cycle after auxiliary shaft gear" is established when the auxiliary shaft does not exist.<br>[Operation status at error occurrence]<br>Synchronous control does not start. | • Set a value within the range of 0 to 3.<br>• Set other than "3: Current value per cycle after auxiliary shaft gear" when the auxiliary shaft does not exist. |
| 1C27H | Outside cam axis current value per cycle (Initial setting) range | The synchronous parameter "[Pr.468] Cam axis current value per cycle (Initial setting)" is set other than 0 to (Cam axis length per cycle - 1).<br>[Operation status at error occurrence]<br>Synchronous control does not start. | Set within the range of 0 to (Cam axis length per cycle - 1). |
| 1C28H | Cam axis current value per cycle restoration disable | Cam axis current value per cycle corresponding to the current feed value at synchronous control start could not be restored when the synchronous parameter "[Pr.462] Cam axis position restoration object" was "0: Cam axis current value per cycle restoration". (Occurs in reciprocated cam pattern)<br>[Operation status at error occurrence]<br>Synchronous control does not start. | • Start synchronous control after moving the current feed value as to fit within the stroke of two-way operation cam pattern.<br>• Set the cam reference position as to fit within the stroke of two-way operation cam pattern. |
| 1C29H | Cam axis current feed value restoration disable | Restoration could not be completed when the synchronous parameter "[Pr.462] Cam axis position restoration object" was "2: Cam axis current feed value restoration", because the difference between the restored cam axis current feed value and the current feed value at synchronous control start (pulse command unit) was larger than the servo parameter "In-position range".<br>[Operation status at error occurrence]<br>Synchronous control does not start. | • Start synchronous control after calculating the cam axis current feed value to be restored, using the cam position calculation function, and moving the current feed value.<br>• Set a larger setting value for the servo parameter "In-position range", if the current value is extremely small (such as 0). |

# Servo amplifier detection error

For details of servo amplifier detection errors, refer to each servo amplifier instruction manual.

# APPENDICES



## Appendix 1 Module Label

The functions of the Simple Motion module can be set by using module labels. The names of module labels can be changed from an engineering tool.

### Default module label

The names of the default module labels are defined with the following configuration.

#### ■Module label of I/O signals

"Module name"_"[x]"."Label name"_"[ax]"

- "Module name": Indicates the character string of a module model name.
- "[x]": A number starting from 1 for identifying modules with the same module name
- "Label name": Unique label name of a module
- "[ax]": Indicates the axis No. corresponding to the module label. A numerical value from 0 to 15 is used for [ax] according to the axes from 1 to 16.

#### ■Module label of buffer memory areas

"Module name"_"[x]"."Data type"_"_D[ax]"."Label name"_"D"

- "Module name": Indicates the character string of a module model name.
- "[x]": A number starting from 1 for identifying modules with the same module name
- "Data type": Indicates the classification of a buffer memory area.
- "[ax]": Indicates the axis No. corresponding to the module label. A numerical value from 0 to 15 is used for [ax] according to the axes from 1 to 16.
- "Label name": Unique label name of a module
- "D": Indicates whether the module label is for auto refresh or direct access. For direct access, "_D" is added after the label name and to "[ax]". The following shows the differences between auto refresh and direct access.

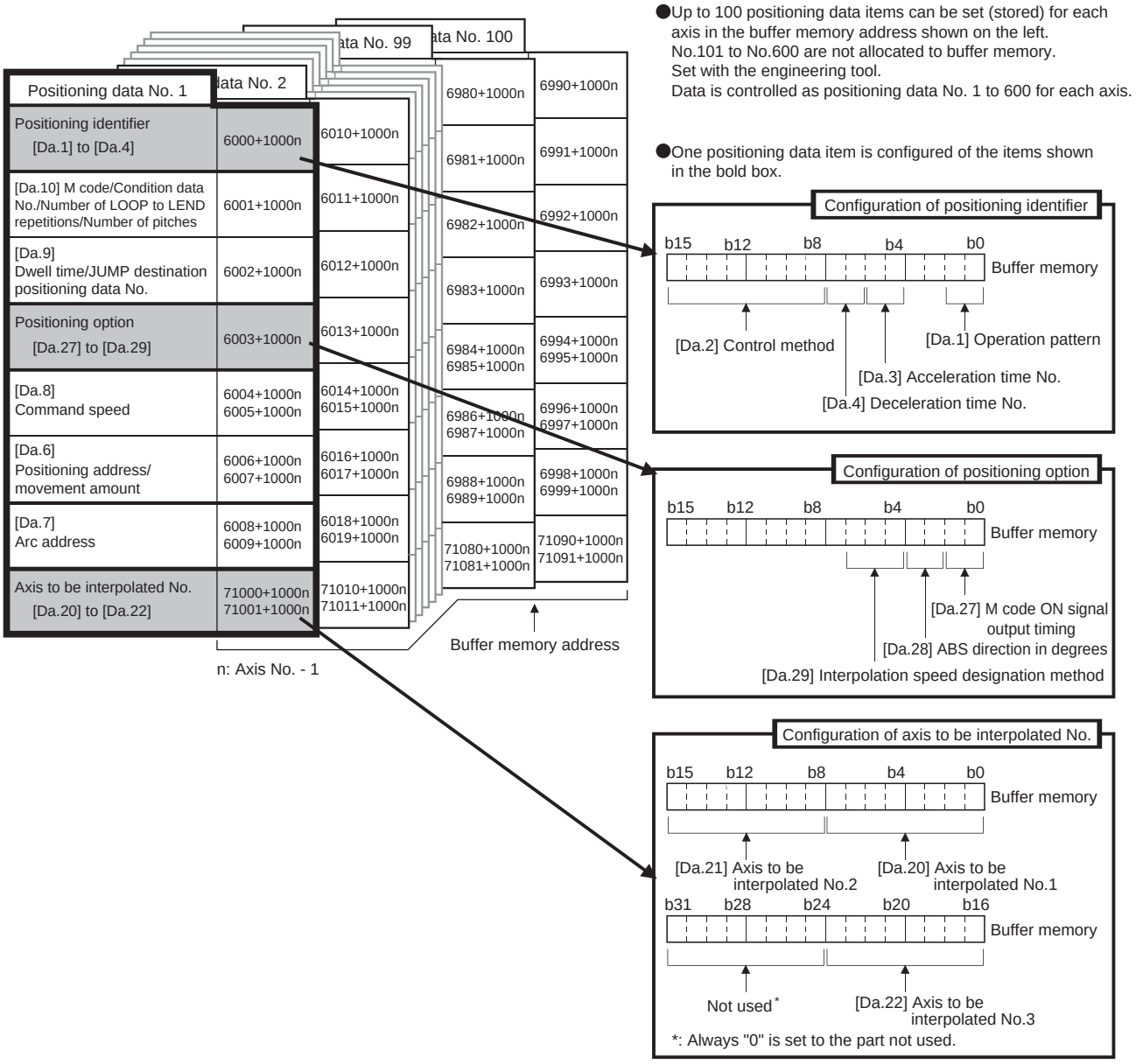
| Type | Description | Access timing |
|---|---|---|
| Auto refresh | Reading/writing data from/to the module label is reflected to the Simple Motion module at auto refresh. The execution time of a program can be shortened. To use auto refresh, "Refresh Destination" must be set to "Module Label" in "Refresh settings" of "Module Parameter". | At auto refresh |
| Direct access | Reading/writing data from/to the module label is reflected to the Simple Motion module immediately. The execution time is longer than the one at auto refresh, but the responsiveness is high. | At reading/writing data from/to the module label |

# Appendix 2 How to Find Buffer Memory Addresses

This section describes how to find the buffer memory addresses of positioning data, block start data, and condition data.

## Positioning data

Positioning data No.1 to No.100 are assigned to each axis. Positioning data has the following structure.




When setting positioning data using a program, determine buffer memory addresses using the following calculation formula and set the addresses.

- $6000^{*1} + (1000 \times (Ax - 1)) + 10 \times (N - 1) + S$

*1 The value is 71000 when setting "[Da.20]" to "[Da.22]".

For each variable, substitute a number following the description below.

| Variable | Description |
|---|---|
| Ax | The axis number of the buffer memory address to be determined. Substitute a number from 1 to 16. |
| N | The positioning data No. of the buffer memory address to be determined. Substitute a number from 1 to 100. |
| S | Substitute one of the following numbers according to the buffer memory address to be determined.<br>• Positioning identifier ([Da.1] to [Da.4], [Da.20] to [Da.22]): 0<br>• [Da.10] M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches: 1<br>• [Da.9] Dwell time/JUMP destination positioning data No.: 2<br>• Positioning option ([Da.27] to [Da.29]): 3<br>• [Da.8] Command speed (lower 16 bits): 4<br>• [Da.8] Command speed (upper 16 bits): 5<br>• [Da.6] Positioning address/movement amount (lower 16 bits): 6<br>• [Da.6] Positioning address/movement amount (upper 16 bits): 7<br>• [Da.7] Arc address (lower 16 bits): 8<br>• [Da.7] Arc address (upper 16 bits): 9 |

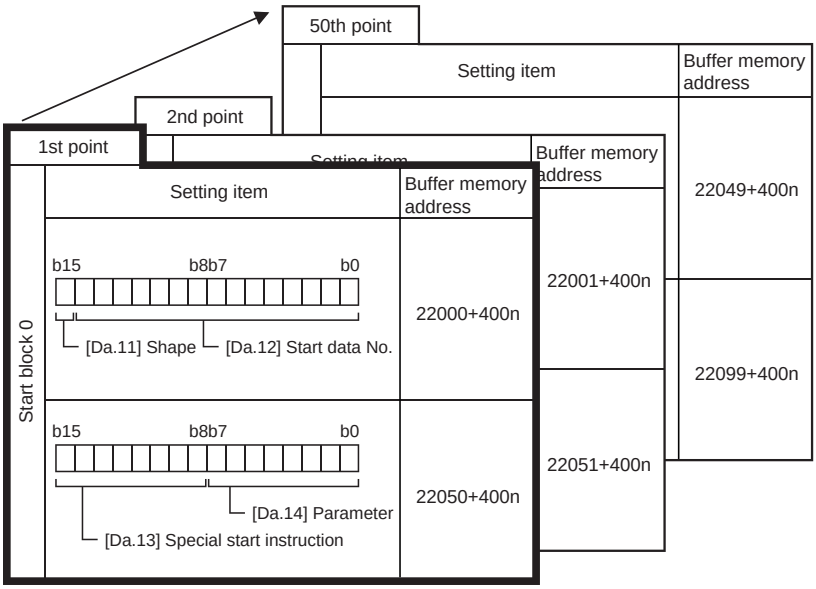
**Ex.**

When the buffer memory address of "[Da.9] Dwell time/JUMP destination positioning data No." of the positioning data No.1 of axis 2 is determined

6000 + (1000 × (2 - 1)) + 10 × (1 - 1) + 2 = 7002

## Block start data

Block start data consists of five start blocks from Start block 0 to 4, and the block start data of 1 to 50 points is assigned to each block. The start blocks are assigned to each axis. Block start data has the following structure.




- Up to 50 block start data points can be set (stored) for each axis in the buffer memory addresses shown on the left.
- Items in a single unit of block start data are shown included in a bold frame.
- Each axis has five start blocks (block Nos. 0 to 4).
  Start block 2 to 4 are not allocated to buffer memory.
  Set with the engineering tool.

n: Axis No. - 1

When setting block start data using a program, determine buffer memory addresses using the following calculation formula and set the addresses.

### ■[Da.11] Shape, [Da.12] Start data No.

Use the following calculation formula.

- 22000 + (400 × (Ax - 1)) + (200 × M) + (P - 1)

For each variable, substitute a number following the description below.

| Variable | Description |
|---|---|
| Ax | The axis number of the buffer memory address to be determined. Substitute a number from 1 to 16. |
| M | The start block No. of the buffer memory address to be determined. Substitute a number from 0 to 4. |
| P | The block start data point of the buffer memory address to be determined. Substitute a number from 1 to 50. |

Ex.

When the buffer memory address that satisfies the following conditions is determined

- Axis 3
- Start block No.2
- Block start data point: 40

22000 + (400 × (3 - 1)) + (200 × 2) + (40 - 1) = 23239

### ■[Da.13] Special start instruction, [Da.14] Parameter

Use the following calculation formula.

- 22050 + (400 × (Ax - 1)) + (200 × M) + (P - 1)

For each variable, substitute a number following the description below.

| Variable | Description |
|---|---|
| Ax | The axis number of the buffer memory address to be determined. Substitute a number from 1 to 16. |
| M | The start block No. of the buffer memory address to be determined. Substitute a number from 0 to 4. |
| P | The block start data point of the buffer memory address to be determined. Substitute a number from 1 to 50. |

Ex.

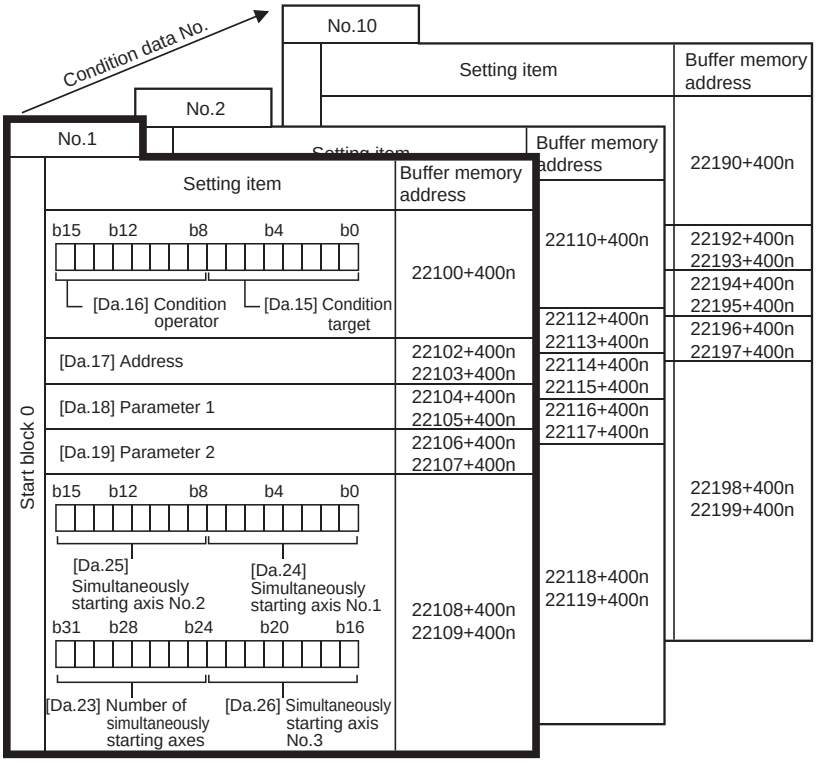
When the buffer memory address that satisfies the following conditions is determined

- Axis 2
- Start block No.1
- Block start data point: 25

22050 + (400 × (2 - 1)) + (200 × 1) + (25 - 1) = 22674

## Condition data

Condition data consists of five start blocks from Start block 0 to 4, and the condition data No.1 to 10 are assigned to each block. The start blocks are assigned to each axis. Condition data has the following structure.




- Up to 10 condition data points can be set (stored) for each block No. in the buffer memory addresses shown on the left.
- Items in a single unit of condition data are shown included in a bold frame.
- Each axis has five start blocks (block Nos. 0 to 4).
  Start block 2 to 4 are not allocated to buffer memory.
  Set with the engineering tool.

n: Axis No. - 1

When setting block start data using a program, determine buffer memory addresses using the following calculation formula and set the addresses.

- 22100 + (400 × (Ax - 1)) + (200 × M) + (10 × (Q - 1)) + R

For each variable, substitute a number following the description below.

| Variable | Description |
|---|---|
| Ax | The axis number of the buffer memory address to be determined. Substitute a number from 1 to 16. |
| M | The start block No. of the buffer memory address to be determined. Substitute a number from 0 to 4. |
| Q | The condition data No. of the buffer memory address to be determined. Substitute a number from 1 to 10. |
| R | Substitute one of the following numbers according to the buffer memory address to be determined.<br>• [Da.15] Condition target: 0<br>• [Da.16] Condition operator: 0<br>• [Da.17] Address (lower 16 bits): 2<br>• [Da.17] Address (upper 16 bits): 3<br>• [Da.18] Parameter 1 (lower 16 bits): 4<br>• [Da.18] Parameter 1 (upper 16 bits): 5<br>• [Da.19] Parameter 2 (lower 16 bits): 6<br>• [Da.19] Parameter 2 (upper 16 bits): 7<br>• [Da.23] to [Da.26] Simultaneously starting axis (lower 16 bits): 8<br>• [Da.23] to [Da.26] Simultaneously starting axis (upper 16 bits): 9 |

**Ex.**

When the buffer memory address that satisfies the following conditions is determined

- Axis 4
- Start block No.3
- Condition data No.5
- [Da.19] Parameter 2 (lower 16 bits)

22100 + (400 × (4 - 1)) + (200 × 3) + (10 × (5 - 1)) + 6 = 23946

# Appendix 3 Compatible Devices with SSCNETIII(/H)

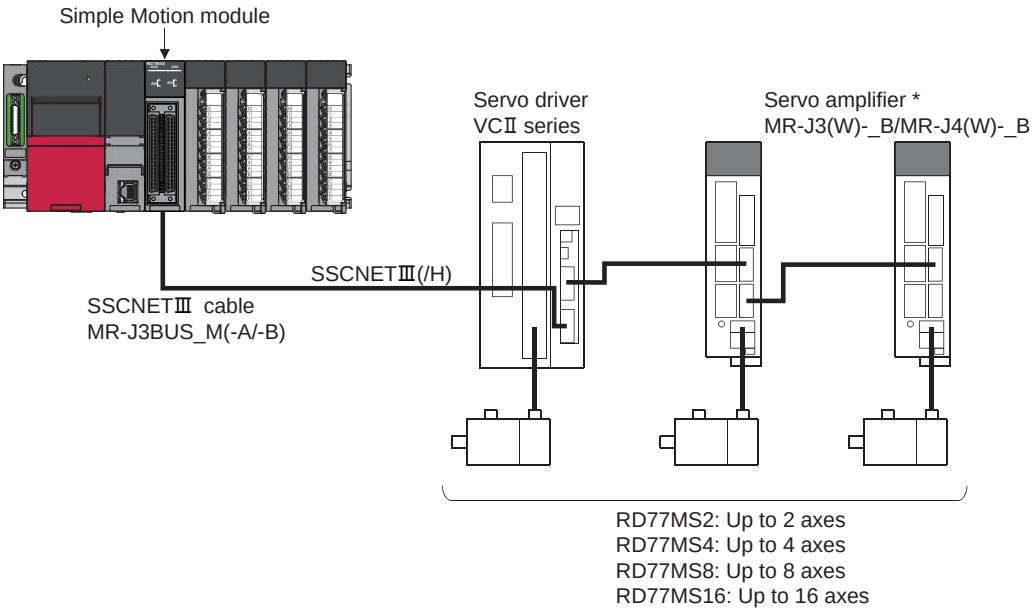
## Servo driver VCII series manufactured by Nikki Denso Co., Ltd.

The direct drive τDISC/τiD roll/τServo compass/τLinear stages, etc. manufactured by Nikki Denso Co., Ltd. can be controlled by connecting with the servo driver VCⅡ series manufactured by the company using SSCNETⅢ or SSCNETⅢ/H.
Contact to Nikki Denso overseas sales office for details of VCⅡ series.

### Connecting method

#### ■System configuration

The system configuration using VCⅡ series is shown below.




* MR-JE-_B can be connected via SSCNETⅢ/H.

#### ■Parameter setting

To connect VCⅡ series, set the following parameters.

n: Axis No.-1

| Setting item | | Setting value | Default value | Buffer memory address |
|---|---|---|---|---|
| [Pr.100] | Connected device | 00080102H: VCⅡ (Manufactured by Nikki Denso Co., Ltd.) (For linear stage)*1<br>00080107H: VCⅡ (Manufactured by Nikki Denso Co., Ltd.) (For direct drive motor)*1<br>00081000H: VCⅡ (Manufactured by Nikki Denso Co., Ltd.)*2 | 0 | 58020+32n<br>58021+32n |

*1 For SSCNETⅢ connection
*2 For SSCNETⅢ/H connection

**Point**

Parameters set in VCⅡ series are not controlled by the Simple Motion module.

## Comparisons of specifications with MR-J4(W)-B/MR-J3(W)-B

| Item | | VCⅡ series[*1] | MR-J4(W)-B | MR-J3(W)-B |
|---|---|---|---|---|
| [Pr.100] Connected device | | 00080102H: VCⅡ (Manufactured by Nikki Denso Co., Ltd.) (For linear stage)<br>00080107H: VCⅡ (Manufactured by Nikki Denso Co., Ltd.) (For direct drive motor)<br>00081000H: VCⅡ (Manufactured by Nikki Denso Co., Ltd.) | 00001000H: MR-J4-_B, MR-J4W-_B (2-, 3-axis type) | 00000100H: MR-J3-_B, MR-J3W-_B (2-axis type)<br>00000101H: MR-J3-_B-RJ006 (For fully closed loop control)<br>00000102H: MR-J3-_B-RJ004 (For linear servo motor)<br>00000107H: MR-J3-_B-RJ080W (For direct drive motor) |
| Control of servo amplifier parameters | | Controlled by VCⅡ series. | Controlled by Simple Motion module. | |
| Input filter setting | | Setting is not available. (fixed to 0.88 ms) | Setting is available. | |
| Detailed parameter 1 | [Pr.116] FLS signal selection | External input signals of VCⅡ series are available. | External input signals of servo amplifier are available. | |
| | [Pr.117] RLS signal selection | | | |
| | [Pr.118] DOG signal selection | | | |
| Expansion parameter | [Pr.91] to [Pr.94] Optional data monitor: Data type setting | The following items can be monitored.<br>1: Effective load ratio<br>2: Regenerative load ratio<br>3: Peak load ratio<br>5: Position loop gain 1<br>8: Encoder multiple revolution counter<br>20: Position feedback<br>21: Encoder single revolution position | The following items can be monitored.<br>1: Effective load ratio<br>2: Regenerative load ratio<br>3: Peak load factor<br>4: Load inertia moment ratio<br>5: Model loop gain<br>6: Bus voltage<br>7: Servo motor rotation speed<br>8: Encoder multiple revolution counter<br>9: Module power consumption<br>10: Instantaneous torque<br>12: Servomotor thermistor temperature<br>13: Equivalent disturbance torque<br>14: Overload alarm margin<br>15: Error excessive alarm margin<br>16: Settling time<br>17: Overshoot amount<br>20: Position feedback<br>21: Encoder single revolution position<br>22: Selection droop pulse<br>23: Module integral power consumption<br>24: Load side encoder information 1<br>25: Load side encoder information 2<br>26: Z-phase counter<br>27: Servomotor side/load-side position deviation<br>28: Servomotor side/load-side speed deviation<br>30: Module power consumption (2 words) | The following items can be monitored.<br>1: Effective load ratio<br>2: Regenerative load ratio<br>3: Peak load factor<br>4: Load inertia moment ratio<br>5: Model loop gain<br>6: Bus voltage<br>7: Servo motor rotation speed<br>8: Encoder multiple revolution counter<br>12: Servomotor thermistor temperature<br>20: Position feedback<br>21: Encoder single revolution position<br>22: Selection droop pulse<br>24: Load side encoder information 1<br>25: Load side encoder information 2 |
| Absolute position system | | Possible[*2] | Possible | |
| Unlimited length feed | | Possible[*3] | Possible | |
| Home position return method | | Near-point dog method, Count method 1, Count method 2, Data set method, Scale origin signal detection method | | |
| Positioning control, Expansion control | | Position control mode, Speed control mode, Torque control mode | Position control mode, Speed control mode, Torque control mode, Continuous operation to torque control mode | |
| Torque limit value change | | Possible (Separate setting: Restrictions[*4]) | Possible | |
| Gain changing command | | Valid | Valid | |
| PI-PID switching command | | Valid | Valid | |
| Control loop (semi/fully) switching command | | Invalid | Valid when using servo amplifier for fully closed loop control | |

| Item | VCⅡ series[*1] | MR-J4(W)-B | MR-J3(W)-B |
|---|---|---|---|
| Amplifier-less operation function | Possible (Operates artificially as one of the followings during amplifier-less operation.<br>• Servo amplifier type: MR-J4-10B, Motor type: HG-KR053 (resolution per servomotor rotation: 4194304 pulses)<br>• Servo amplifier type: MR-J3-10B, Motor type: HF-KP053 (resolution per servomotor rotation: 262144 pulses)) | | |
| Servo parameter change request | Possible (2 words write) | Possible (1 word write) | |
| Driver communication | Not possible | Possible[*5] | |
| Monitoring of servo parameter error No. | Not possible | Possible | |
| Servo alarm/warning | Alarm codes/warning codes detected by VCⅡ series are stored in "Servo alarm/warning". | Alarm codes/warning codes detected by servo amplifier are stored in "Servo alarm/warning". | |
| Programming tool | MR Configurator2 is not available.<br>Use VCⅡ data editing software. | MR Configurator2 is available. | |

*1 Confirm the specifications of VCⅡ series for details.
*2 The direct drive τDISC series manufactured by Nikki Denso Co., Ltd. can restore the absolute position in the range from -2147483648 to 2147483647. Confirm the specifications of VCⅡ series for restrictions by the version of VCⅡ series.
*3 When using the virtual encoder pulse number function of VCⅡ series, the unlimited length feed is available. When this function is not used, the unlimited length feed is not available. Confirm the specifications of VCⅡ series for details of this function.
*4 The specification of torque limit direction differs by the version of VCⅡ series. Confirm the specifications of VCⅡ series for details.
*5 Refer to each servo amplifier instruction manual for the servo amplifiers that can be used.

## Precautions during control

### ■Absolute position system (ABS)/Incremental system (INC)

The setting of ABS/INC operates by the setting of VCⅡ.

### ■Unlimited length feed

When using the virtual encoder pulse number function of VCⅡ series, the unlimited length feed is available. When this function is not used, the servo error 61468 (F01CH) "Absolute encoder over flow error" occurs after "Encoder multiple revolution counter × Encoder resolution + Encoder single revolution position" exceeds the range of -2147483648 to 2147483647, and the operation stops.

### ■Home position return

When "1" is set in the first digit of the parameter of VCⅡ series "Select function for SSCNETⅢ on communicate mode", it is possible to carry out the home position return without passing the zero point. (Return to origin after power is supplied will be executed when passing of Motor Z phase is not necessary.) When "0" is set, the error "Home position return zero point not passed" (error code: 197AH) occurs because the home position return is executed without passing the motor Z phase (Motor reference position signal).

### ■Control mode

Control modes that can be used are shown below.

- Position control mode (speed control including position control and position loop)
- Speed control mode (speed control not including position loop)
- Torque control mode (torque control)

However, it is not available to switch to continuous operation to torque control mode of expansion control "Speed-torque control". If the mode is switched to continuous operation to torque control mode, the error "Continuous operation to torque control not supported" (error code: 19E7H) occurs and the operation stops.

"1: Feedback torque" cannot be set in "Torque initial value selection (b4 to b7)" of "[Pr.90] Operation setting for speed-torque control mode". If it is set, the warning "Torque initial value selection invalid" (warning code: 09E5H) occurs and the command value immediately after switching is the same as the case of selecting "0: Command torque".

### ■Servo parameter

• Control of servo parameters

Parameters of VCⅡ series are not controlled by Simple Motion module. Therefore, even though the parameter of VCⅡ series is changed during the communication between Simple Motion module and VCⅡ series, it does not reflect to the buffer memory.

• Servo parameter change request

Change request of servo parameter ("[Cd.130] Servo parameter write request" to "[Cd.132] Change data") can be executed. However, the servo parameter of VCⅡ series is controlled in a unit of 2 words, so that it is necessary to set "2: 2 words write request" in "[Cd.130] Servo parameter write request" for executing the parameter write. If 1 word write is executed to VCⅡ series, the parameter write is failure, and "3" is stored in "[Cd.130] Servo parameter write request".

When the servo parameter of VCⅡ series is changed by the servo parameter change request, the parameter value after changing the servo parameter cannot be confirmed using VCⅡ data editing software. Also, when the power of VCⅡ series is turned OFF, the parameter changed by the servo parameter change request becomes invalid, and the value written by VCⅡ data editing software becomes valid.

### ■Optional data monitor

The following table shows data types that can be set.

| Data type | Unit |
|---|---|
| Effective load ratio | [%] |
| Regenerative load ratio | [%] |
| Peak load ratio | [%] |
| Model control gain | [rad/s] |
| Encoder multiple revolution counter | [rev] |
| Position feedback (Used point: 2 words) | [pulse] |
| Encoder single revolution position (Used point: 2 words) | [pulse] |

### ■Gain changing command, PI-PID switching request, Semi/Fully closed loop switching request

Gain changing command and PI-PID switching request are available.

Semi/fully closed loop switching request becomes invalid.

### ■Driver communication

The driver communication is not supported. If the driver communication is set in a servo parameter, the error "Driver communication setting error" (error code: 1C93H) will occur when the power is turned ON, and any servo amplifiers including VCⅡ series cannot be connected.

## VCⅡ series detection error/warning

When an error occurs at VCⅡ series, the error code is stored in "[Md.23] Axis error No.". The servo alarm of VCⅡ series (0x00 to 0xFF) is stored in "[Md.114] Servo alarm". The alarm detailed number is not stored.

"0" is always stored in "[Md.107] Parameter error No.".

Confirm the specifications of VCⅡ series for details of errors and warnings.

# Inverter FR-A700 series

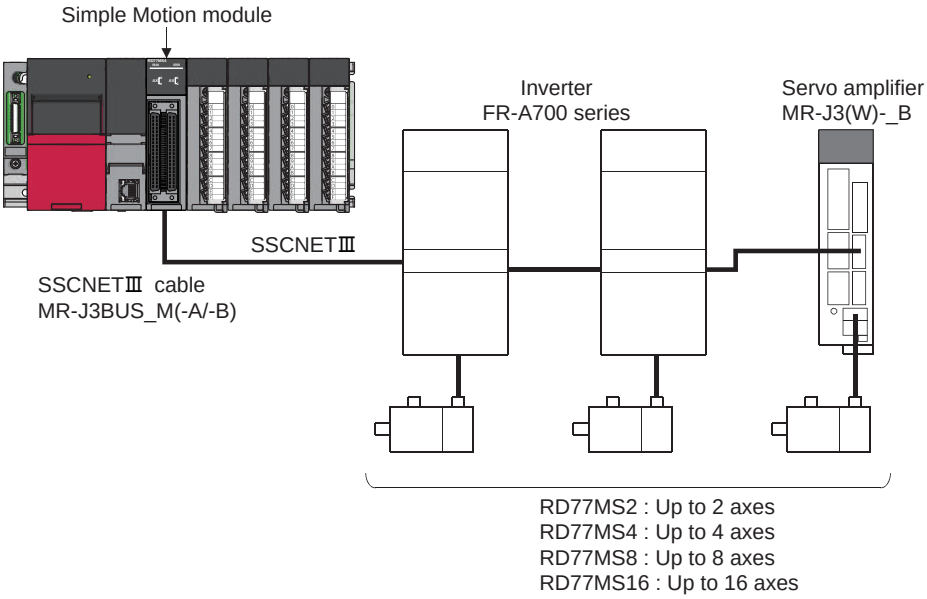
FR-A700 series can be connected via SSCNETⅢ by using built-in option FR-A7AP and FR-A7NS.

## Connecting method

### ■System configuration

The system configuration using FR-A700 series is shown below.

Set "0: SSCNETⅢ" in "[Pr.97] SSCNET setting" to use FR-A700 series.




### ■Parameter setting

To connect FR-A700 series, execute flash ROM writing after setting the following parameters to buffer memory. The setting value is valid when the power supply is turned ON or the CPU module is reset.

"[Pr.97] SSCNET setting": "0: SSCNETⅢ"

"[Pr.100] Connected device": "00004100H: FR-A700 (Inverter)", "00004101H: FR-A700-NA (Inverter)", "00004102H: FR-A700-EC (Inverter)", "00004103H: FR-A700-CHT (Inverter)"

### ■Control of FR-A700 series parameters

Parameters set in FR-A700 series are not controlled by Simple Motion module. Set the parameters by connecting FR-A700 series directly with the operation panel on the front of inverter (FR-DU07/FR-PU07) or FR Configurator that is inverter setup software. Confirm the specifications of FR-A700 series for details of the setting items.

**Point**

In the state of connecting between FR-A700 series and Simple Motion module, only a part of parameters can be set if the parameter of the inverter "[Pr.77] Parameter write selection" is in the initial state. Set "2: Write parameters during operation" to rewrite the parameters of FR-A700 series.

## ■Reset selection/disconnected PU detection/PU stop selection

When PU stop is executed in FR-A700 series, position error excessive, etc. occur because a command from Simple Motion module does not stop. Set "0 to 3" in the parameter of the inverter "[Pr.75] Reset selection/ disconnected PU detection/PU stop selection". To stop FR-A700 series, use the stop signal and the forced stop of Simple Motion module, or use the output stop (MRS) of FR-A700 series.

| Setting item | | Default value | Setting value | Details |
|---|---|---|---|---|
| [Pr.75] | Reset selection/disconnected PU detection/ PU stop selection | 14*1 | 0 | • Reset input is always enabled.<br>• If the PU is disconnected, operation will be continued.<br>• PU stop is disabled at SSCNETⅢ connection. |
| | | | 1 | • A reset can be input only when the protective function is activated.<br>• If the PU is disconnected, operation will be continued.<br>• PU stop is disabled at SSCNETⅢ connection. |
| | | | 2 | • Reset input is always enabled.<br>• When the PU is disconnected, the inverter trips.<br>• PU stop is disabled at SSCNETⅢ connection. |
| | | | 3 | • A reset can be input only when the protective function is activated.<br>• When the PU is disconnected, the inverter trips.<br>• PU stop is disabled at SSCNETⅢ connection. |
| | | | 14 | • Reset input is always enabled.<br>• If the PU is disconnected, operation will be continued.<br>• Deceleration stop by PU stop in any operation mode. |
| | | | 15 | • A reset can be input only when the protective function is activated.<br>• If the PU is disconnected, operation will be continued.<br>• Deceleration stop by PU stop in any operation mode. |
| | | | 16 | • Reset input is always enabled.<br>• When the PU is disconnected, the inverter trips.<br>• Deceleration stop by PU stop in any operation mode. |
| | | | 17 | • A reset can be input only when the protective function is activated.<br>• When the PU is disconnected, the inverter trips.<br>• Deceleration stop by PU stop in any operation mode. |

*1 Note that the default value is set to "14". (Change the value to "0 to 3".)

## ■In-position range

Set the servo parameter "In-position range (PA10)" and the parameter of the inverter "[Pr.426] In-position width" to be matched. Otherwise, it may not operate correctly.

n: Axis No. - 1

| Setting item | | Default value | Setting range | Buffer memory address |
|---|---|---|---|---|
| PA10 | In-position range | 100 (pulse) | 0 to 65535 (pulse) | 28410+100n |

| Setting item | | Default value | Setting range | Details |
|---|---|---|---|---|
| [Pr.426] | In-position width | 100 (pulse) | 0 to 32767 (pulse) | When droop pulses have fallen below the setting value, the in-position signal turns ON. |

## ■Optional data monitor setting

The following table shows data types that can be set.

| Data type | Name at FR-A700 series use |
|---|---|
| Effective load ratio | Motor load factor |
| Load inertia moment ratio | Load inertia ratio |
| Model control gain | Position loop gain |
| Bus voltage | Converter output voltage |
| Encoder multiple revolution counter | Absolute position encoder multiple revolution counter |
| Position feedback | Position feedback |
| Encoder single revolution position | Absolute position encoder single revolution position |

### Precautions

When FR-A700 series is used, each data is delayed for "update delay time + communication cycle" because of the update cycle of the inverter. The following table shows the update delay time of each data.

| Data type | Update delay time of FR-A700 series |
|---|---|
| Effective load ratio | 12.5 ms |
| Load inertia moment ratio | 56 ms or more (up to 2500 ms) |
| Model control gain | 56 ms or more (up to 2500 ms) |
| Bus voltage | 9.888 ms |
| Encoder multiple revolution counter | 222 μs |
| Position feedback | 222 μs |
| Encoder single revolution position | 222 μs |

## ■External input signal

Set as the followings to fetch the external input signal (FLS/RLS/DOG) via FR-A700 series.

- Set "1: External input signal of servo amplifier" in "[Pr.116] FLS signal selection", "[Pr.117] RLS signal selection", or "[Pr.118] DOG signal selection".
- Set the parameters of the inverter as below. (Otherwise, each signal remains OFF.)

| Setting item | | Default value | Setting value | Details |
|---|---|---|---|---|
| [Pr.178] | STF terminal function selection | 60 | 60 | Use with the default value. |
| [Pr.179] | STR terminal function selection | 61 | 61 | Use with the default value. |
| [Pr.185] | JOG terminal function selection | 5 | 76 | Set 76 (Near-point dog). |
| [Pr.449] | SSCNETⅢ input filter setting | 4 | 0: None<br>1: 0.88 ms<br>2: 1.77 ms<br>3: 2.66 ms<br>4: 3.55 ms | Set the input filter setting value at reading an external signal. |

- Set the servo parameter of Simple Motion module "Input filter setting (PD11)" to be the same value as the parameter of the inverter "[Pr.449] SSCNETⅢ input filter setting".

| Setting item | | Default value | Setting value | Details |
|---|---|---|---|---|
| PD11 | Input filter setting | 4 | 0: None<br>1: 0.88 ms<br>2: 1.77 ms<br>3: 2.66 ms<br>4: 3.55 ms | Set the input filter setting value at reading an external signal. |

## Comparisons of specifications with MR-J3(W)-B

| Item | | FR-A700 series*1 | MR-J3(W)-B |
|---|---|---|---|
| [Pr.100] Connected device | | 00004100H: FR-A700 (Inverter)<br>00004101H: FR-A700-NA (Inverter)<br>00004102H: FR-A700-EC (Inverter)<br>00004103H: FR-A700-CHT (Inverter) | 00000100H: MR-J3-_B, MR-J3W-_B (2-axis type) |
| Control of servo amplifier parameters | | Set directly by inverter. (Not controlled by Simple Motion module.) | Controlled by Simple Motion module. |
| Detailed parameter 1 | [Pr.116] FLS signal selection | External input signals of FR-A700 series are available. | External input signals of servo amplifier are available. |
| | [Pr.117] RLS signal selection | | |
| | [Pr.118] DOG signal selection | | |
| Expansion parameter | [Pr.91] to [Pr.94] Optional data monitor: Data type setting | The following items can be monitored.<br>1: Motor load factor<br>4: Load inertia ratio<br>5: Position loop gain<br>6: Converter output voltage<br>8: Absolute position encoder multiple revolution counter<br>20: Position feedback<br>21: Absolute position encoder single revolution position | The following items can be monitored.<br>1: Effective load ratio<br>2: Regenerative load ratio<br>3: Peak load factor<br>4: Load inertia moment ratio<br>5: Model loop gain<br>6: Bus voltage<br>7: Servo motor rotation speed<br>8: Encoder multiple revolution counter<br>12: Servomotor thermistor temperature<br>20: Position feedback<br>21: Encoder single revolution position<br>22: Selection droop pulse<br>24: Load side encoder information 1<br>25: Load side encoder information 2 |
| Absolute position system | | Not possible | Possible |
| Positioning control, Expansion control | | Position control mode, Speed control mode, Torque control mode | Position control mode, Speed control mode, Torque control mode, Continuous operation to torque control mode |
| Gain changing command | | Valid | Valid |
| PI-PID switching command | | Valid | Valid |
| Control loop (semi/fully) switching command | | Invalid | Valid when using servo amplifier for fully closed loop control |
| Servo parameter write/read | | Not possible | Possible |
| Amplifier-less operation function | | Possible*2 | Possible |
| | | (Operates artificially as the followings during amplifier-less operation. Servo amplifier type: MR-J3-10B, Motor type: HF-KP053 (resolution per servomotor rotation: 262144 pulses)) | |
| Driver communication | | Not possible | Possible*3 |
| Monitoring of servo parameter error No. | | Not possible | Possible |
| Servo alarm/warning | | Alarm codes/warning codes detected by FR-A700 series are stored in "Servo alarm/warning". | Alarm codes/warning codes detected by servo amplifier are stored in "Servo alarm/warning". |
| Programming tool | | MR Configurator2 is not available.<br>Use FR-DU07/FR-PU07 or FR Configurator. | MR Configurator2 is available. |

*1 Confirm the specifications of FR-A700 series for details.

*2 Parameters set in FR-A700 series are not controlled by Simple Motion module. Therefore, the operation is the same as when the servo parameter "Rotation direction selection/travel direction selection (PA14)" is set as below during amplifier-less operation mode.

| Setting item | | Setting value | Details |
|---|---|---|---|
| PA14 | Rotation direction selection/travel direction selection | 0 | Positioning address increase: CCW or positive direction |
| | | | Positioning address decrease: CW of negative direction |

*3 Refer to each servo amplifier instruction manual for the servo amplifiers that can be used.

## Precautions during control

### ■Absolute position system (ABS)/Incremental system (INC)

When using FR-A700 series, absolute position system (ABS) cannot be used. Even though "1: Enable (absolute position detection system)" is set in the servo parameter "Absolute position detection system (PA03)", the servo amplifier operates as incremental system.

- When the Simple Motion module is powered ON, home position return request is turned ON and the current feed value is set to 0. (The current feed value is also set to 0 if only the power of inverter is turned OFF to ON.)
- The warnings at absolute position system "Home position return data incorrect" (warning code: 093CH) and "SSCNET communication error" (warning code: 093EH) are not detected.

### ■Control mode

Control modes that can be used are shown below.

- Position control mode (speed control including position control and position loop)
- Speed control mode (speed control not including position loop)
- Torque control mode (torque control)

However, it is not available to switch to continuous operation to torque control mode of expansion control "Speed-torque control". If the mode is switched to continuous operation to torque control mode, the error "Continuous operation to torque control not supported" (error code: 19E7H) occurs and the operation stops.

"1: Feedback torque" cannot be set in "Torque initial value selection (b4 to b7)" of "[Pr.90] Operation setting for speed-torque control mode". If it is set, the warning "Torque initial value selection invalid" (warning code: 09E5H) occurs and the command value immediately after switching is the same as the case of selecting "0: Command torque".

### ■Driver communication

The driver communication is not supported. If the driver communication is set in a servo parameter, the error "Driver communication setting error" (error code: 1C93H) will occur when the power is turned ON.

### ■Control mode switching of speed-torque control

The axis connected with FR-A700 series takes more time to switch the control mode than the axis connected with the servo amplifier.

| Switching operation | Switching time at the servo amplifier use | Switching time at FR-A700 series use |
|---|---|---|
| Position control mode → Speed control mode | 6 to 11 ms | 19 to 24 ms |
| Speed control mode → Position control mode | | |
| Position control mode → Torque control mode | | |
| Torque control mode → Position control mode | | |
| Speed control mode → Torque control mode | | |
| Torque control mode → Speed control mode | | |

## FR-A700 series detection error/warning

When an error occurs at FR-A700 series, the error code is stored in "[Md.23] Axis error No.".

The alarm number of FR-A700 series is stored in "[Md.114] Servo alarm". However, "0" is always stored in "[Md.107] Parameter error No.".

Confirm the specifications of FR-A700 series for details of errors and warnings.

# Connection with MR-JE-B



The servo amplifier MR-JE-B can be connected using SSCNETⅢ/H.

## Comparisons of specifications with MR-J4(W)-B

| Item | | MR-JE-B | MR-J4(W)-B |
|---|---|---|---|
| [Pr.100] Connected device | | 00001200H: MR-JE-_B | 00001000H: MR-J4-_B |
| Operation mode | | Standard | Standard/Fully closed/Linear/Direct drive |
| Detailed parameter 1 | [Pr.116] FLS signal selection | External input signals of servo amplifier are not available.*1 | External input signals of servo amplifier are available. |
| | [Pr.117] RLS signal selection | | |
| | [Pr.118] DOG signal selection | | |
| Control loop (semi/fully) switching command | | Invalid | Valid when using servo amplifier for fully closed loop control |
| Encoder resolution | | 131072 pulses/rev | 4194304 pulses/rev |
| Amplifier-less operation function | | Possible*2 | Possible |
| Driver communication | | Not possible | Possible |
| Virtual servo amplifier function | | Not possible | Possible |

*1 When "1: Servo amplifier" is set in "[Pr.116] FLS signal selection" to "[Pr.118] DOG signal selection" at MR-JE-B use, the axis error or warning does not occur and the external signal (upper/lower limit switch, near-point dog) cannot be operated. To use the external input signal at MR-JE-B use, set "2: Buffer memory". Refer to the following for the program and the system configuration.
☞ Page 308 External Input Signal Select Function

*2 Operates artificially as the following servo amplifier and servo motor during amplifier-less operation mode.
Servo amplifier type: MR-J4-10B
Motor type: HG-KR053 (Resolution per servo motor rotation: 4194304 pulses)

**Restriction**

The servo amplifier MR-JE-B is integrated with the main circuit power supply and the control power supply. Therefore, when the power of the servo amplifier is turned OFF, the controller cannot communicate with the axes after the axis whose power is turned OFF.

# Appendix 4 Restrictions by the version

There are restrictions in the function that can be used by the software of the Simple Motion module and the version of engineering tool.

The combination of each version and function are shown below.

| Function | Software version | Engineering tool | Reference |
|---|---|---|---|
| Event history Flash ROM writing | Ver.03 or later | — | *1 |
| Inter-module synchronization start | | — | |
| Advanced synchronous control<br>Slippage smoothing method (Linear: Input value follow up) | | 1.007H or later | *2 |
| Cam axis length per cycle change | | | |
| MR-JE-B | | | *1 |
| Hot line forced stop function | | — | |
| Online module change | | — | |
| 3-axis helical interpolation control | | 1.007H or later | |

*1 Refer to the following for details.
MELSEC iQ-R Simple Motion Module User's Manual (Application)

*2 Refer to the following for details.
MELSEC iQ-R Simple Motion Module User's Manual (Advanced Synchronous Control)

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# REVISIONS

* The manual number is given on the bottom left of the back cover.

| Revision date | *Manual number | Description |
|---|---|---|
| June 2014 | IB(NA)-0300247-A | First edition |
| February 2015 | IB(NA)-0300247-B | ■Added functions<br>3-axis helical interpolation control, Inter-module synchronization function, Online module change, Hot line forced stop function<br>■Added or modified parts<br>RELEVANT MANUALS, TERMS, Section 1.1, 1.2, 1.3, 2.1, 2.2, 3.1, 3.2, 4.1, 4.2, 4.3, 4.4, 5.1, 5.2, 5.3, 5.4, Chapter 6, Section 7.1, 8.2, 8.4, 8.5, 8.6, 8.8, 8.9, 9.1, 9.2, 9.3, 9.4, 9.5, 9.8, 9.9, 9.10, 9.11, 9.13, 9.14, Chapter 10, Section 11.3, 12.1, 12.2, 12.3, 12.4, 12.5, 12.6, 12.7, 12.8, 12.9, 13.1, 13.2, 13.3, 13.4, 14.1, 14.2, 14.3, 14.4, 14.5, Appendix 2, 3, 4 |

Japanese manual number: IB-0300246-B

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[Gratis Warranty Term]

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[Gratis Warranty Range]

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IB(NA)-0300247-B(1502)MEE
MODEL: RD77-U-APP-E
MODEL CODE: 1XB014

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